UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213

SEP 20 2002

In Reply Refer to:
SWR-01-SA-5667:BFO

Mr. Chester V. Bowling
Operations Manager
United States Bureau of Reclamation
Central Valley Operations Office
3310 El Camino Ave., Suite 300
Sacramento, California 95821

Dear Mr. Bowling:

This letter transmits the National Marine Fisheries Service's (NOAA Fisheries) biological opinion (Enclosure 1) on interim operations of the Central Valley Project (CVP) and State Water Project (SWP) between April 1, 2002, and March 31, 2004 (hereinafter referred to as the Project), on federally listed threatened Central Valley spring-run Chinook salmon and threatened Central Valley steelhead in accordance with section 7 of the Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. 1531 et seq.). Your letter dated November 26, 2001, initiated formal consultation and included a draft biological assessment.

The enclosed biological opinion includes the amendment issued to you in our letter, dated April 2, 2002, concerning extending the consultation until May 31, 2002. In that letter we added new language concerning the incidental take of steelhead at the CVP/SWP Delta Fish Facilities. The previous language was changed to reflect the seasonal nature of the fish salvage operations.

Based upon the best available scientific and commercial information, NOAA Fisheries has determined that the Project, is not likely to jeopardize the continued existence of federally threatened Central Valley spring-run Chinook salmon and threatened Central Valley steelhead or result in the destruction or adverse modification of designated critical habitat for these species.

The enclosed biological opinion contains an analysis of the effects of the Project on designated critical habitat. Shortly before the issuance of this opinion, however, a federal court vacated the rule designating critical habitat for Central Valley spring-run Chinook salmon and Central Valley steelhead. The analysis and conclusions regarding critical habitat remain informative for our application of the jeopardy standard even though they no longer have independent legal significance. Also, in the event critical habitat should be redesignated before the action is fully implemented, the analysis will be relevant when determining whether a reinitiation of consultation would be necessary at that time. For these reasons and the need to timely issue this biological opinion, our critical habitat analysis remains.

In addition, Section 305(b)(2) of the Magnuson-Stevens Fisheries Conservation and Management Act (MSA) requires federal agencies to consult with NOAA Fisheries on all actions or proposed actions authorized, funded, or undertaken by the agency that may adversely affect Essential Fish Habitat (EFH) for federally managed fish species. The action area for the Project includes areas identified as EFH for various life stages of salmon species federally managed under the Pacific Coast Salmon Fishery Management Plan. Based on the best available information, NOAA Fisheries has determined that the Project may adversely affect EFH. Therefore, conservation recommendations for EFH consultation are provided with this biological opinion (Enclosure 2).

Section 305(b)(4)(B) of the MSA requires the Bureau of Reclamation (Reclamation) to provide NOAA Fisheries with a detailed written response within 30 days to these EFH Conservation Recommendations, including a description of measures adopted by Reclamation for avoiding, minimizing, or mitigating the impact of the proposed action on EFH (50 CFR 600.920(j)). In the case of a response that is inconsistent with NOAA Fisheries' recommendations, Reclamation must explain the reason for not following the recommendations, including the scientific justification for any disagreements with NOAA Fisheries over the anticipated effects of the Project and the measures needed to avoid, minimize, or mitigate such effects. For more information on EFH, see our website at http://swr.nmfs.noaa.gov.

If you have any questions concerning these consultations, please contact Mr. Bruce Oppenheim in our Sacramento Area Office, 650 Capitol Mall, Suite 8-300, Sacramento, California 95814. Mr. Oppenheim may be reached by telephone at (916) 930-3603 or by FAX at 916-930-3629.

Sincerely,

Rodney R McInnis

Rodney R. McInnis
Acting Regional Administrator

Enclosures

cc:

Mr. Frank Michny
Regional Environmental Officer
United States Bureau of Reclamation
2800 Cottage Way
Sacramento, California 95825-1898

Mr. Carl Torgersen
California Department of Water Resources
3310 El Camino Ave., Suite 300

Sacramento, California 95821

Ms. Barbara McDonnell
Environmental Services Office
California Department of Water Resources
3251 S Street
Sacramento, California 95819

Mr. Jim White
California Department of Fish and Game
1416 Ninth Street
Sacramento, California 95814

Mr. Wayne White
U.S. Fish and Wildlife Service
2800 Cottage Way
Sacramento, California 95825

Mr. Roger Guinee
U.S. Fish and Wildlife Service
2800 Cottage Way, Room #W-2605
Sacramento, California 95825

Stephen A. Meyer
ASAC, NOAA Fisheries
650 Capitol Mall, Suite 8-300
Sacramento, California 95814

Enclosure 1

Endangered Species Act -Section 7 Consultation

BIOLOGICAL OPINION

Agency: U.S. Bureau of Reclamation, Mid-Pacific Region, Sacramento, California

Activity: Central Valley Project (CVP) and State Water Project (SWP) Operations, April 1, 2002 through March 31, 2004

Consultation Conducted By: National Marine Fisheries Service, Southwest Region.

Date Issued: SEP 20 2002

I. INTRODUCTION

This document transmits the National Marine Fisheries Service's (NOAA Fisheries) biological opinion on Central Valley Project (CVP) and State Water Project (SWP) Operations from April 1, 2002 through March 31, 2004 (hereinafter referred to as the Project) on federally listed threatened Central Valley spring-run Chinook salmon (*Oncorhynchus tshawytscha*), and threatened Central Valley steelhead (*O. mykiss*) in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.).

This biological opinion is based on our review of information referenced in and provided with a letter dated November 26, 2001 from the Bureau of Reclamation (Reclamation) initiating formal consultation on the effects of the Project including: 1) a Biological Assessment with additional Appendices A through I, dated December 2001; 2) supplemental documents *Provisional Fall/Winter Juvenile Salmon Decision Process*, dated November 14, 2000 and *February through March Juvenile Salmon Decision Process*, revised March 8, 2001; 3) the February 15, 2002 forecasts of 50 percent and 90 percent exceedence; 4) a series of temperature models for each CVP/SWP river using the 50, 90, and 75 percent exceedence forecasts; and 5) monthly meetings with agency staff between May and December 2001. A complete administrative record of this consultation is on file at the NOAA Fisheries, Sacramento Area Office.

Operation forecasts using hydrologic conditions were prepared for two cases: 90/75 percent (dry year) and 50 percent (median year) based on historical probability of exceedence levels. Therefore, in the 90 percent exceedence case there is only a 10 percent probability that the forecasted flows would occur, the 75 percent exceedence forecast is likely to occur 25 percent of the time, and the 50 percent exceedence forecast would be the most likely case to occur. These forecasts are intended to quantify the outcomes of the proposed operations of the Project in accordance with existing operational criteria, which are described in the project description.

Reclamation concluded in their biological assessment dated December 2001 that existing protections and enhancements in freshwater habitats and the Delta are sufficient to avoid jeopardizing the continued existence of Central Valley (CV) steelhead, CV spring-run Chinook salmon and fall-run Chinook salmon *(O. tshawytscha)* from March 2002 through March 2004. This biological opinion evaluates the effects of the Project and determines whether those effects are likely to jeopardize the continued existence of the affected ESA-listed salmon and steelhead or result in the destruction or adverse modification of designated critical habitat.

Although this consultation only considers operations from April 2002 through March 2004, the proposed action includes Reclamation's continued efforts to negotiate with water rights holders for long-term CVP contracts. Dependant on these long-term contracts is a flow augmentation program, which includes the use of 800 thousand acre feet (TAF) of Central Valley Improvement Act (CVPIA) (b)(2) water and 380 TAF of the CALFED Bay-Delta Program (CALFED) Environmental Water Account (EWA) water to benefit salmon and steelhead. This consultation is intended to allow sufficient time (i.e. two years) for Reclamation to evaluate and model the long-term and cumulative effects of operations with these programs, at which time NOAA Fisheries anticipates a subsequent ESA section 7(a)(2) consultation to assess the effects of the long-term operations, criteria and plan (OCAP).

CVP/SWP operations alter the quantity, timing, and quality of water passing through the Central Valley into the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Delta), thereby affecting the conditions under which juvenile and adult salmonids migrate through the river reaches and spawn and rear downstream of project dams.

To achieve the objectives of this biological opinion, NOAA Fisheries uses a five-step approach for applying the ESA section 7(a)(2) standards:

1. Define the biological requirements and current status of each listed species.

2. Evaluate the significance of the environmental baseline with regard to the current status of the species.

3. Determine the effects of the proposed or continuing action on listed species.

4. Determine whether the proposed action reduces the likelihood of survival and recovery of the species under the effects of the environmental baseline, and any cumulative effects for each life-stage.

5. Identify reasonable and prudent alternatives (RPAs) to a proposed action if the action is likely to jeopardize the continued existence of a listed species or destroy or adversely modify its critical habitat. This step is relevant only when the conclusion of Step 4, above, is that the proposed action would jeopardize listed species.

The fourth step of the above approach calls for a two-part analysis. The first part focuses on the action area, delineated as the geographic extent of direct and indirect effects of the action (50 CFR§ 402.02). The analysis places the action area in the context of the full salmon life cycle, considering population level biological requirements (i.e. genetic diversity, demographic and environmental variation). The second part of the analysis determines how the effects of the action, environmental baseline, and cumulative effects are considered together relative to the biological requirements of the listed species.

To fully consider the current status of the listed species NOAA Fisheries evaluates the biological requirements of the species, subspecies, or distinct population segment. For Pacific salmonids, NOAA Fisheries evaluates the population level requirements as they relate to evolutionary significant units (ESUs).

In the absence of full recovery planning, NOAA Fisheries strives to ascribe the appropriate significance to actions to the extent available information allows. Where information is not available on the recovery needs of the species, such as with CV steelhead, NOAA Fisheries applies a conservative substitute that is likely to exceed what would be expected of an action if information were available.

Consultation History

On March 27, 2000, NOAA Fisheries issued an interim biological opinion to Reclamation and the California Department of Water Resources (DWR) that assessed the effects of the CVP-OCAP on Federally threatened CV spring-run Chinook salmon and threatened CV steelhead and for the period December 1, 1999, through March 31, 2000. Based on the best information available, the biological opinion concluded that CVP/SWP operations were not likely to jeopardize the continued existence of CV spring-run Chinook salmon or CV steelhead, or result in the destruction or adverse modification of critical habitat for these species. However, some incidental take of steelhead and spring-run Chinook salmon was anticipated and authorized take levels for each species were specified in an incidental take statement. Since the issuance of the March 27, 2000, biological opinion, NOAA Fisheries has worked with Reclamation and DWR, through the CALFED Operations Group (CALFED-OPS) and the CVPIA to minimize impacts associated with CVP/SWP operations and ensure that incidental take does not exceed specified take levels.

On August 28, 2000, CALFED issued a Record of Decision (ROD) that lays out a 30-year program for increasing water supply reliability to California water users and restoring the Central Valley ecosystem. Recognizing that implementation of the CALFED Program will result in changes to CVP/SWP operations over the 30-year life of the program, NOAA Fisheries, Reclamation and DWR agreed that a long-term CVP-OCAP consultation should be conducted after the CALFED ROD was released. However, considerable modeling and other analysis relative to CVP/SWP operations and the CALFED Program must be completed to initiate this consultation for long-term operations. Therefore, NOAA Fisheries, Reclamation, and DWR agreed to conduct annual consultations for CVP and SWP operations based on the most current water supply and operations forecasts until a long-term CVP-OCAP consultation for CV spring-run Chinook salmon and CV steelhead can be completed.

Reclamation's facilities to be addressed in this interim consultation include all CVP units, except the Friant Division and Lewiston Dam of the Trinity River Division. DWR's facilities to be addressed in this interim consultation include the following: Oroville-Thermalito Complex, Harvey O. Banks Delta Pumping Plant, Clifton Court Forebay, Skinner Fish Protective Facility, Northbay Aqueduct, and the Suisun Marsh Salinity Control Structure. Facilities and operations of CVP and SWP contractors are not addressed in this consultation and, thus, are not provided authorization for incidental take through this consultation.

Regularly scheduled meetings between NOAA Fisheries, Reclamation, DWR and the California Department of Fish and Game (DFG) were initiated in July 2000. Results of monitoring, stranding, and redd studies for Clear Creek, Stanislaus and Feather River were presented by DFG and DWR at a meeting in September 2000. Results from American River monitoring were obtained from unpublished data (Snider, per. com. 2000). Target dates for the interim biological opinion were announced at the January 2001 meeting.

By letter dated December 18, 2000, Reclamation initiated formal consultation with NOAA Fisheries for the period April 2000, through March 2001, and provided a biological assessment dated November 2000. An initial project description was included in the biological assessment along with the most recent revision of draft *Juvenile Chinook Salmon Decision Process for October 1, 2000 through January 31, 2001* (formerly the Spring-Run Protection Plan).

On January 6, 2001, Reclamation requested that NOAA Fisheries extend the consultation period through March 2002, based upon an updated January forecast (with Shasta Criteria triggered) and new temperature studies. Dry hydrologic conditions had persisted during water year (WY) 2001, and Reclamation's 90 percent exceedence forecast projected conditions would be critical with high initial storage (C-HI) going into the following year.

By letter dated February 23, 2001, Reclamation provided additional supplemental information with revised operations forecasts and temperature studies for the SWP, Feather River, to update the project description presented in the December 18, 2000 letter. Reclamation also requested that in order to extend the consultation period, NOAA Fisheries base their assessment of potential effects to CV spring-run Chinook salmon and CV steelhead on the latest 50 and 90 percent exceedence forecasts dated February 15, 2001 (i.e. official water year forecast to CVP contractors).

On May 8, 2001, NOAA Fisheries issued an interim biological opinion to Reclamation and DWR that assessed the effects of CVP-OCAP for the period January 1, 2001, through March 31, 2002. Based on the best information available, the opinion concluded that CVP/SWP operations were not likely to jeopardize the continued existence of CV spring-run Chinook salmon or CV steelhead, or result in the destruction or adverse modification of critical habitat for these species. However, some incidental take of steelhead and spring-run Chinook salmon was anticipated and authorized take levels for each species were specified in an incidental take statement.

By letter dated November 26, 2001, Reclamation initiated formal consultation for the enclosed two year opinion with NOAA Fisheries, covering CVP/SWP operations from March 2002, through March 2004, and provided a Draft Biological Assessment. Reclamation requested that the consultation be completed by February 28, 2002. A Final Biological Assessment dated December 2001 was issued on January 24, 2002.

Meanwhile, scoping meetings for a Long-Term CVP-OCAP consultation were initiated by Reclamation after January 24, 2002, between NOAA Fisheries, DWR, DFG, and the U.S. Fish and Wildlife Service (FWS), to construct a framework to proceed using the newly completed CALSIM II modeling. Cumulative impacts addressing the issuance of long-term CVP and SWP contracts for the next 25 years are to be included in this modeling. The agencies recognize that the first step in this process would be to acquire additional biological information as identified in this consultation. Reclamation staff expects to have this completed by February 2003.

On April 2, 2002, NOAA Fisheries requested an extension of the current consultation period until May 31, 2002 and amended the existing incidental take statement for CV steelhead. NOAA Fisheries determined the effect of extending the existing opinion for 60 days would not likely jeopardize the continued existence of CV steelhead or CV spring-run Chinook salmon because (1) the Vernalis Adaptive Management Plan (VAMP) was being implemented, (2) temporary barriers were installed in the Delta that would direct salmonids away from the pumps, (3) data from existing monitoring sites indicated low salmon abundance in the Sacramento River, (4) pulse flows were released to improve juvenile salmonid outmigration, and (5) the peak of salvage at the Delta Fish Facilities had passed.

II. DESCRIPTION OF PROPOSED ACTION

A. Description of Central Valley Project Facilities Upstream of the Delta

1. <u>Trinity River Division</u>

a. Background

The Trinity River Division, completed in 1964, includes facilities to store and regulate water in the Trinity River, as well as facilities to divert water to the Sacramento River Basin. The main facilities of the division include the Trinity Dam and Powerplant; Trinity Reservoir (2.45 million acre feet –[MAF] capacity); Lewiston Dam, Lake, and Powerplant; Clear Creek Tunnel; Judge Francis Carr Powerhouse; Whiskeytown Dam and Lake (241 TAF capacity); Spring Creek Tunnel and Powerplant; and Spring Creek Debris Dam and Reservoir (5.8 TAF capacity).

Trinity Reservoir releases are re-regulated downstream at Lewiston Dam and Lake to meet downstream flow, in-basin diversion, and downstream temperature requirements. Lewiston Lake also provides a forebay for the trans-basin diversion of flows through the Clear Creek Tunnel and the Judge Francis Carr Powerhouse into Whiskeytown Lake on Clear Creek.

Water stored in Whiskeytown Lake includes exports from the Trinity River as well as runoff from the Clear Creek drainage. A majority of the water released from Whiskeytown Lake travels through the Spring Creek Tunnel and Powerplant and is discharged into Keswick Reservoir on the Sacramento River. A small amount of water from the lake is also released through the Whiskeytown Dam outlet works and the City of Redding Powerplant into Clear Creek which flows into the Sacramento River below Keswick Dam.

The Spring Creek Debris Dam is also a feature of the Trinity River Division of the CVP. It was constructed in 1963 to regulate runoff containing acid mine drainage from Iron Mountain Mine in the Spring Creek watershed. The Spring Creek Debris Dam can store up to approximately 5.8 TAF of water. Runoff containing acid mine drainage from several inactive copper mines and exposed ore bodies at Iron Mountain Mine is stored in Spring Creek Reservoir. Since 1990 concentrations of toxic metals in acidic drainage from Iron Mountain Mine has progressively decreased due to several remedial actions including the construction and operation of a lime neutralization plant. Operation of the Spring Creek Debris Dam and Shasta Dam has allowed some control of the toxic wastes with dilution criteria.

Two agreements govern releases from Whiskeytown Lake to Clear Creek: a 1960, Memorandum of Agreement (MOA) with DFG, and the October 6, 1999, Department of the Interior (Interior) Final Decision (hereafter referred to as DOI Final Decision) on implementation of Section 3406 (b)(2) of the CVPIA. The 1960 MOA with DFG established minimum flows to be released into Clear Creek from Whiskeytown Dam. Subsequently, in 1963 a release schedule from Whiskeytown Dam was developed and implemented, but was never finalized. The October 6, 1999, DOI Final Decision allows for establishment of the target flow objectives described in the November 20, 1997, Interior Final Administrative Proposal on the Management of Section 3406(b)(2) Water, which includes the Anadromous Fish Restoration Program (AFRP) actions [CVPIA Section 3406 (b)(1)]. The AFRP Plan identifies minimum instream flows for Clear Creek below Whiskeytown based upon thresholds of Trinity Reservoir storage. Target flows range from 100 to 200 cfs from October through May and from 100 to 150 cfs from June through September.

b. Proposed Operations from April 1, 2002 through March 31, 2004

(1) Trinity and Lewiston Dams. Currently, due to the December 19, 2000 Trinity River Record of Decision and a 2001 preliminary injunction the CVP has had to increase the annual allocation of Trinity flows from 340 TAF to 369 TAF. Reclamation has assumed 369 TAF for forecasting purposes in this opinion. Exports of Trinity water to the Sacramento Basin are determined after consideration is given to forecasted Trinity water supply and Trinity in-basin needs, including carryover storage. Trinity exports provide increased water supply, power generation, and temperature control in the upper Sacramento River for the CVP. In WY 2002 through March 2004, Reclamation proposes to coordinate the timing of Trinity exports with releases at Shasta to best meet temperature objectives on the upper Sacramento that were established in the 1993 NOAA Fisheries winter-run biological opinion (WRO).

(2) Whiskeytown Dam and Reservoir on Clear Creek. In WY 2002 through March 2004, Reclamation proposes to operate Whiskeytown Dam to regulate inflows for power generation and recreation; to support upper Sacramento temperature objectives; and to provide releases to Clear Creek consistent with AFRP flow objectives.

Under the 50, 90 and 75 percent exceedence forecasts, monthly average flows are predicted to remain at 150 cfs in all years, except November through December when they will increase to 200 cfs into Clear Creek. The proposed flows are based upon AFRP restoration objectives that are intended to increase fish passage and attraction flows; decrease water temperatures; and increase spawning, incubation, rearing, and emigration habitat for fall and late fall Chinook salmon and steelhead. Pulse flows up to 1,200 cfs were proposed for May to attract spring-run adults from the Sacramento River, but have not been implemented due to concerns over attracting winter-run Chinook. Releases from Whiskeytown Reservoir into Clear Creek that are above the pre-CVPIA base-case (50-100 cfs) are usually made using Section 3406 (b)(2) water. The FWS recommends to Reclamation the amount of (b)(2) water to be released in coordination with NOAA Fisheries at the weekly B2IT meetings.

In November, 2000 the McCormick-Saeltzer Dam at RM 6.5 was removed by Interior to provide fish passage to upstream habitat below Whiskeytown Reservoir. Reclamation proposes to provide AFRP summertime flows of 150 cfs for fish passage upstream of the old dam. A monitoring program is being conducted by FWS in conjunction with DFG to provide Reclamation with recommendations for suitable flow releases for steelhead and spring-run salmon. Flushing flows to coincide with high storm events have been proposed for restoration, sediment removal, and to attract spring-run Chinook spawners. In the 90% exceedence forecast there may not be enough (b)(2) water to accomplish, as was the case in 2001. Reclamation has not proposed any ramping criteria for Whiskeytown releases, but the FWS has conducted studies involving ramping rates that could be used. A Fisheries Management Plan involving NOAA Fisheries, CDFG, and FWS for Clear Creek is expected to be completed by the end of the consultation period.

(3) Temperature control in Clear Creek. Reclamation did not actively manage temperatures on Clear Creek until 2001, when due to input from the Clear Creek Restoration Team and the interim OCAP biological opinion, 56°F down to Igo was maintained for steelhead, spring-run Chinook, and fall-run Chinook. Monthly mean temperatures predicted from the 50%, 75% and 90% forecasts are below 60°F all year from Whiskeytown Dam to the mouth, based on proposed WY 2002 through 2004 flow conditions. For both 90% and 50% exceedence forecast, mean monthly temperatures at the mouth of Clear Creek are below 56°F from January through May and

October through December, while temperatures from June through September range from 58°F to 63°F. However, if flows are decreased to 50 cfs (i.e., base-case without CVPIA (b)(2) water) during the summer months the mean temperatures at the mouth of Clear Creek would be significantly increased.

(4) Spring Creek Debris Dam. In WY 2002 through March 2004, Reclamation proposes to implement actions that will protect the Sacramento River system from heavy metal pollution (acid mine runoff) from Spring Creek Dam and adjacent watersheds. These actions were identified in a 1980 Memorandum of Understanding (MOU) established between Reclamation, DFG, and the SWRCB. According to the MOU, when storage within Spring Creek Reservoir is less than 5 TAF, Reclamation is able to make controlled releases that result in allowable concentrations of total copper and zinc in the Sacramento River below Keswick Dam. When Spring Creek Reservoir storage exceeds 5 TAF and water must be released, the MOU provides for emergency relaxation of these criteria, which leads to a 50% increase in the objective concentrations of copper and zinc. In recent years Reclamation, DFG, and the Regional Water Quality Control Board (RWQCB) have agreed not to use the emergency criteria until a spill is imminent. In January 2002 Spring Creek Debris Dam did spill and Shasta releases were raised to dilute the heavy metals concentration. The MOU states that Reclamation agrees to operate according to the established criteria and schedules as long as operations will not cause flood control parameters on the Sacramento River to be exceeded or interfere unreasonably with other project requirements as determined by Reclamation. Reclamation also has primary responsibility for monitoring concentrations of copper and zinc at Spring Creek Debris Dam and in the Sacramento River below Keswick Dam, however, DFG and RWQCB also collect and analyze samples on an as-needed basis.

2. Shasta Division

a. Background

The Shasta Division of the CVP includes facilities that conserve water on the Sacramento River for flood control, navigation maintenance, conservation of fish in the Sacramento River, protection of the Delta from intrusion of saline ocean water, agricultural water supplies, municipal and industrial (M&I) water supplies, and hydroelectric generation. The Shasta Division includes Shasta Dam, Lake, and Powerplant; Keswick Dam, Reservoir, and Powerplant; and the Toyon Pipeline. Shasta Dam and Lake (4.55 MAF capacity) is the largest storage reservoir on the Sacramento River. Completed in 1945, Shasta Dam controls flood water and stores winter runoff for various uses in the Sacramento and San Joaquin valleys. Keswick Dam, located approximately 9 miles downstream from Shasta Dam creates an afterbay (23 TAF capacity) for Shasta Lake and Trinity River diversions. Keswick Dam and Reservoir stabilizes the peak hydroelectric operation water releases from Spring Creek and Shasta Powerplants. Anadromous fish trapping facilities at Keswick Dam are operated in conjunction with the FWS. Some of the salmon trapped at the Keswick fish trap are taken for use as broodstock at the

Coleman National Fish Hatchery approximately 25 miles downstream of Keswick Dam on Battle Creek, tributary to the Sacramento River.

Approximately 5 miles downstream of Keswick Dam, the Anderson-Cottonwood Irrigation District (ACID) has been diverting water for irrigation from the Sacramento River since 1916. The ACID diversion dam and canal operate seasonally from the spring through fall of each year to deliver irrigation water supplies along the westside of the Sacramento River between Redding and Cottonwood. A contractual agreement between the Federal Government and ACID provides for diversion of water and requires Reclamation to reduce Keswick Dam releases to accommodate the installation, removal, or adjustment of boards associated with the ACID diversion dam.

Reclamation operates the Shasta, Sacramento River, and Trinity River divisions of the CVP to meet, to the extent possible, the provisions of SWRCB Order 90-05 and the WRO. In 1990 and 1991, the SWRCB issued Water Rights Orders 90-05 and 91-01 modifying Reclamation's water rights for the Sacramento River. These SWRCB orders include temperature objectives for the Sacramento River including a daily average water temperature of 56°F at Red Bluff Diversion Dam (RBDD) during periods when higher temperatures would be harmful to the fishery. Under the orders, the compliance point may be changed when the objective can not be met at RBDD. In addition, Order 90-05 modified the minimum flow requirements in the Sacramento River below Keswick Dam initially established in the 1960 MOA between Reclamation and DFG. Minimum flow requirements established by the WRO are more conservative than most of the minimum flow requirements of SWRCB Order 90-05.

Flood control objectives for Shasta Lake require that releases are restricted to quantities that will not cause downstream flows or stages to exceed specified levels. Maximum flood space reservation is 1.3 MAF with variable storage space requirements based on an inflow parameter. The flood control criteria for Shasta specify that releases should not be increased more than 15,000 cfs or decreased more than 4,000 cfs in any one-hour period. In rare instances, the rate of decrease may have to be accelerated to avoid exceeding critical flood stages downstream.

Although not an authorized purpose, recreational use of Shasta Lake is significant with the prime recreation season extending from Memorial Day through Labor Day. Reclamation attempts to have Shasta Lake full by Memorial Day and at an elevation of no less than 1,017 feet on Labor Day. Customary patterns of storage and release usually result in acceptable water levels during the prime recreational season.

b. Proposed Operations from April 1, 2002 through March 31, 2004

(1) Shasta Dam and Reservoir (Shasta Lake). In WY 2002 through March 2004, Reclamation proposes to operate the Shasta Reservoir level to meet the needs of the CVP and to meet the provisions of SWRCB Order 90-05 and the WRO. The forecasted water year for 2002 is classified as *Dry* with low to medium initial reservoir storage. Predicted end-of-September 2002 carryover storage for Shasta Lake is 2.5 MAF, well above the required 1.9 MAF required in the WRO.

(2) Minimum stream flows in the Upper Sacramento River. In WY 2002 through March 2004, Reclamation proposes to provide release flows at Keswick Dam and Red Bluff Diversion Dam that are, equal to, or exceed AFRP flow objectives (see description under CVPIA criteria) during most months under the 50% exceedence forecast. In the 90% and 75% exceedence forecasts January through March flows are held at the minimum (3,250 cfs) requirement established in the WRO. The WRO did not require minimum flows from April through September, however, a minimum temperature criteria was established for these months resulting in the adaptive management of higher release flows by Reclamation to achieve temperature compliance.

Reclamation currently implements ramping criteria established by the reasonable and prudent alternative of the WRO. Ramping constraints for Keswick release reductions are from July 1 through March 31 and include the following:

a. Releases must be reduced between sunset and sunrise.
b. When Keswick release is 6,000 cfs or greater, decreases may not exceed 15% per night. Decreases may also not exceed 2.5% in one hour.
c. For Keswick release between 4,000 to 5,999 cfs, decreases may not exceed 200 cfs per night. Decreases may also not exceed 100 cfs per hour.
d. For Keswick releases between 3,999 and 3,250 cfs, decreases may not exceed 100 cfs per night.

From October 15 to December 31, Reclamation attempts to minimize changes in releases from Keswick Dam to provide stable flow conditions for fall-run Chinook salmon production. Normally, releases from Keswick Dam are reduced to the minimum fishery release requirement (either WRO or AFRP) by October 15 of each year. In the 50% exceedence case followed by a 90% exceedence forecast, Reclamation proposes to provide 4,200 cfs in November and 3,750 in December, which exceeds the minimum flows required by the WRO (3,250 cfs) and AFRP objectives. Flood control operations and other emergencies (such as flushing flows to dilute acid mine runoff from Spring Creek Dam) are not affected by the release change limitations.

(3) Temperature control in the Upper Sacramento River. Construction of a temperature control device (TCD) at Shasta Dam was completed in 1997. This device is designed to selectively withdraw water from elevations with Shasta Lake while enabling hydroelectric power generation. The TCD allows greater flexibility in the management of cold water reserves in Shasta Lake for maintenance of adequate water temperatures in the Sacramento River downstream of Keswick Dam. In WY 2002 through March 2004, Reclamation proposes to adaptively manage releases from Shasta Dam to achieve temperature compliance (56°F) in the 90/75% exceedence forecast down to Jellys Ferry (just above Red Bluff), pursuant to the 1993 WRO for the period of April 15 through September 30 and 60°F through October.

For the 50% exceedence forecast, predicted mean monthly Sacramento River temperatures for WY 2002 through March 2004 are below 56°F for all months down to Bend Bridge (downstream of Jellys Ferry, see temperature model forecast 12/01).

Pursuant to SWRCB Water Rights Order 90-05 and 91-01, Reclamation devised and implements the Sacramento-Trinity Water Quality Monitoring Network (see page 17 of the BA) which is used to monitor temperature and other parameters at key locations in the Sacramento and Trinity rivers. Also, as a result of the SWRCB Orders, the Sacramento River Temperature Task Group was convened by Reclamation to formulate, monitor, and coordinate temperature control plans for the upper Sacramento and Trinity rivers with representatives from SWRCB, NOAA Fisheries, FWS, DFG, WAPA, DWR, and the Hoopa Valley Indian Tribe.

(4) Wilkins Slough. Wilkins Slough is located on the mainstem Sacramento River immediately upstream of the confluence with the Feather River. While commercial navigation is no longer a concern on the lower Sacramento River due to the Deep Water Ship Channel, the 5,000 cfs minimum flow established at Chico Landing for navigation served as the basis for the design of many irrigation pumping stations on this reach of the river. Diverters are able to operate for extended periods at flows as low as 4,000 cfs at Wilkins Slough, but pumping operations become severely affected at flows lower than this. In WY 2002 through March 2004, Reclamation proposes flows for the 50% exceedence forecast that just meet the 5,000 cfs minimum flow at Wilkins Slough, however in the 90%/75% exceedence forecasts flows would be below the criteria from November through February.

(5) Anderson-Cottonwood Irrigation District Dam. In WY 2002 through March 2004, Reclamation proposes to meet their contractual obligations with the ACID by manipulating Keswick Dam releases to the extent reasonably needed to facilitate installation, removal, or adjustment of the flashboards on the ACID diversion dam. Because work on the ACID dam can not be safely accomplished at flows greater than 6,000 cfs (April through September), Reclamation proposes to limit Keswick releases at the request of ACID to 5,000 cfs for five days to facilitate installation or removal of the dam.

Reclamation proposes to operate Keswick flow reductions for ACID operations to meet the RPA for flow decreases identified in the WRO. This RPA limits flow reductions above 6,000 cfs to 15% in a 12 hour period (releases limited between sunset to sunrise) and 2.5% in any one hour. Therefore, advance notification is necessary between Reclamation and ACID when scheduling decreases for installation or removal of the ACID dam.

3. <u>Sacramento River Division</u>

a. Background

The Sacramento River Division of the CVP includes facilities for the diversion and conveyance of water to CVP contractors on the west side of the Sacramento River. At Red Bluff, the

Sacramento Canals Unit of the Sacramento River Division includes the Red Bluff Diversion Dam, the Corning Pumping Plant, and the Corning and Tehama-Colusa canals. These facilities provide for diversion and conveyance of irrigation water to over 200,000 acres of land in the Sacramento Valley, principally in Tehama, Glenn, Colusa, and Yolo counties. The Sacramento River Division also includes Black Butte Dam and Lake, which were integrated into the CVP in 1970. The facilities are operated jointly by the Army Corps of Engineers and Reclamation to provide for flood control and for irrigation water supplies, respectively. Black Butte Reservoir provides supplemental water to the Tehama-Colusa Canal as it crosses Stony Creek.

b. Proposed Operations from April 1, 2002 through March 31, 2004

In WY 2002 through March 2004, Reclamation proposes to operate Red Bluff Diversion Dam (RBDD) to meet the RPA identified in the WRO concerning gate operations. This RPA specifies that the diversion dam gates be raised from September 15 through May 14 with a provision that intermittent gate closures of up to ten days may be approved on a case-by-case basis for critical diversion needs. Reclamation has also been involved with a pilot pumping plant to provide water to the Tehama-Colusa Canal during this period when the gates are raised. These pumps have been proven to adequately screen juvenile salmonids but are not large enough to meet full irrigation demands, therefore, since 1992, water has been made available to irrigators from Black Butte Reservoir via Stony Creek.

4. American River Division

a. Background

The American River Division includes the Folsom Unit, Sly Park Unit, and Auburn-Folsom South Unit of the CVP. These facilities conserve water on the American River for flood control, fish and wildlife protection, recreation, protection of the Delta from intrusion of saline ocean water, agricultural water supplies, municipal and industrial (M&I) water supplies, and hydroelectric generation. The Folsom Unit consists of Folsom Dam and Lake (977 TAF capacity), Folsom Powerhouse, Nimbus Dam, Lake Natoma, and Nimbus Powerplant on the American River. The Sly Park Unit which provides water from the Cosumnes River to El Dorado Irrigation District (EID) includes Jenkinson Lake formed by Sly Park Dam on Sly Park Creek, a low concrete diversion dam on Camp Creek, and Sly Park Conduit. The Folsom and Sly Park Units were added to the CVP in 1949. In 1965, the Auburn-Folsom South Unit was authorized and includes County Line Dam, Pumping Plant, and Reservoir; Sugar Pine Dam and Reservoir; Linden and Mormon Island Pumping Plants; Folsom South Canal; and other necessary diversion works, conduits, and appurtenant works for delivery of water supplies to Placer, El Dorado, Sacramento, and San Joaquin counties.

Although Folsom Lake is the main storage and flood control reservoir on the American River, numerous other small reservoirs in the upper basin provide generation and water supply. None of the upstream reservoirs have specific flood control responsibilities. The total upstream storage above Folsom Lake is approximately 820 TAF. Ninety percent of this upstream storage is contained by five reservoirs: French Meadows (219 TAF); Hell Hole (208 TAF); Loon Lake (76 TAF); Union Valley (271 TAF) and Ice House (46 TAF). French Meadows and Hell Hole reservoirs, located on the Middle Fork of the American River are owned and operated by Placer County Water Agency. (PCWA). PCWA provides wholesale water to agricultural and urban areas within Placer County. Loon Lake on the Middle Fork, and Union Valley and Ice House reservoirs on the South Fork of the American River are operated by Sacramento Municipal Utilities District (SMUD).

Reclamation operates the American River Division of the CVP to meet, to the extent possible, the temperature objectives for the Nimbus Fish Hatchery and the American River Trout Hatchery, while maintaining suitable temperatures for instream salmonids. The interagency American River Workgroup (AROG), which consists of representatives from Reclamation, FWS, NOAA Fisheries, DFG, Sacramento County, and Save the American River Association was created in 1996 to provide input to Reclamation regarding fishery status and water temperature conditions on the LAR. The AROG provides input based on current biological data, such as carcass surveys, steelhead redd depth or prespawn mortality in fall-run Chinook salmon.

The COE specifies flood control requirements and regulating criteria for the American River (COE 1987). From June 1 through September 30, no flood control restrictions exist. Full flood reservation space is required from November 17 through February 7. From October 1 through November 16 and from April 21 through May 31, reserved storage space for flood control is a function of the date. Beginning February 8 and continuing through April 20, flood reservation space is a function of both date and wetness. Since 1996, Reclamation has operated to modified flood control criteria which reserves 400 to 670 TAF of flood control space in Folsom Reservoir and a combination of upstream reservoirs (i.e., Hell Hole, Union Valley, and French Meadows).

b. Proposed Operations from April 1, 2002 through March 31, 2004

(1) Folsom Dam and Reservoir (Folsom Lake). From WY 2002 through March 2004, Reclamation proposes to operate Folsom Reservoir levels to meet the needs of the CVP; water delivery to downstream water rights, D-1641 water quality standards, fish and wildlife protection, water supplies to CVP contractors, and to meet the provisions of SWRCB 1995 Water Quality Control Plan (95-1WR) for the Delta.

Predicted end-of-September storage for WY 2002 in Folsom Lake are approximately 700 TAF for the 50% exceedence forecast, and 440 TAF in the 90% exceedence forecast (from 2/15 forecasts). Folsom Dam releases into the American River are re-regulated approximately seven miles downstream by Nimbus Dam.

Through the CVPIA, Reclamation funded a flow study from 1997 through 2000 conducted by DFG to better define criteria for flow fluctuations in the LAR. This report was completed in November 2001 (Snider 2001) and contains recommendations for steelhead and Chinook spawning flows as well as operating criteria to avoid critical rearing periods. Recommended operation criteria included:

a. Ramping rates should not exceed 100 cfs per hour below 4,000 cfs releases.
b. Flow increases above 4,000 cfs should be avoided during critical rearing periods (January - July for young-of-the-year salmon and steelhead and October - March for steelhead yearlings and non-natal rearing winter and spring-run Chinook), unless these flows can be maintained throughout the entire period.
c. Flow decreases below 2,500 during critical spawning periods should be precluded from October - December for fall run Chinook and December - May for steelhead.

Reclamation and the COE propose to conduct a Function Analysis Workshop in August 2002 to determine operational criteria in light of this new study. Until then, Reclamation continues to adaptively manage flows considering input from the AROG and ramping rate criteria in last year§s interim Opinion to reduce the incidence of steelhead and fall run Chinook salmon isolation and stranding events.

(2) Nimbus Dam and Reservoir (Lake Natoma). In WY 2002 through March 2004, Reclamation proposes to operate the Nimbus Reservoir to serve as a forebay for the diversion of water through the Folsom South Canal and to provide releases to the LAR. The Folsom South Canal serves water to agricultural and M&I users in south Sacramento County. Releases from Nimbus Dam to the American River pass through the Nimbus Powerplant (5,000 cfs capacity) or, at flows in excess of 5,000 cfs, the spillway gates.

(3) Minimum Instream Flows in the Lower American River. Reclamation proposes to provide monthly average release flows from Nimbus Dam that are equal to, or exceed AFRP flow objectives during most months. However, under the 90% exceedence forecast, February and March releases in all years would be below AFRP goals. Under the 50% exceedence forecast, proposed monthly average flows are adequate. AFRP flow objectives in the American River are intended to decrease water temperatures and increase spawning, incubation, rearing, and emigration habitat for fall Chinook salmon and steelhead while providing benefits for estuarine species as well.

Installation and removal of the Fish Diversion Weir for fall-run Chinook salmon spawning at the Nimbus Fish Hatchery requires Reclamation to lower the flows in October and again in December to between 500 and 1000 cfs for up to two days.

Currently, flows above the historical base case or D-893 are maintained using discretionary (b)(2) water, if necessary. American River flows are often used to meet the Water Quality Control Plan (WQCP) standards set in D-1641 for the Delta using nondiscretionary (b)(2) water when the need arises, since it is closer than making releases from Keswick Dam.

Regarding seasonal fluctuations and ramping of stream flows in the lower American River (LAR), Reclamation proposes to use a revised criteria based on the ramping rate table in the interim 2001 OCAP biological opinion (see American River temperature control section below). A further revised ramping criteria is presented in table format under the Terms and Conditions of this opinion.

(4) Temperature Control in the Lower American River. Although Reclamation proposes to implement AFRP flow objectives during WY 2002 through March 2004, temperature control problems exist in the LAR due to the small size of the cold water pool available within Folsom Reservoir for downstream releases. Reclamation proposes to continue adaptively managing temperatures on the LAR using a combination of flow releases and shutter operations with input from of AROG.

Temperature goals within the LAR are to provide suitable temperatures during the summer months for Nimbus Fish Hatchery and for instream rearing juvenile steelhead, while minimizing the loss of the cold water pool left available for spawning fall-run Chinook. In WY 2000, efforts made by Reclamation and the AROG to maintain 65°F water temperatures at Watt Ave succeeded in avoiding lethal temperatures for both juvenile steelhead and fall-run Chinook spawners.

Under the 50% exceedence forecast, mean weekly temperatures predicted at Watt Avenue Bridge (the reach containing the majority of known steelhead spawning and rearing habitat) are below 65°F from January through December. In the 90% exceedence forecast, mean weekly water temperatures exceed the lethal limit for steelhead (70°F) in two of the three alternatives modeled (summer shutter operations for steelhead and fall shutter operations for salmonids). The third temperature alternative (unconstrained operation) reached 69°F at Watt Ave from March through September.

Reclamation intends to install a temperature control device (TCD) for the water supply intake at Folsom Dam to allow greater flexibility in the management of cold water reserves in Folsom Lake while enabling hydroelectric power generation. The objective of the TCD is to allow Reclamation to draw warm water off Folsom Reservoir without impacting the cold water pool. The project was authorized in September of 1998, but due to a series of delays has not yet begun construction. It is unknown when this project will be completed, and therefore it can not be assumed to benefit cold water pool management in the next two years.

5. Eastside Division

a. Background

The New Melones Unit of the Eastside Division includes facilities that conserve water on the Stanislaus River for flood control, fish and wildlife protection, bay-delta flow requirements, dissolved oxygen requirements, Vernalis water quality, agricultural water supplies, municipal and industrial (M&I) water supplies, and hydroelectric generation. Facilities consist of New Melones Dam, Reservoir (2.4 MAF), and Powerplant. Other water storage facilities in the Stanislaus River include the Tri-Dam project, a hydroelectric generation project that consists of Donnells and Beardsley dams located upstream of New Melones on the middle fork Stanislaus River, and Tulloch Dam and Powerplant, located approximately six miles below New Melones Dam on the mainstem Stanislaus River. Releases from Donnells and Beardsley dams affect inflows to New Melones Reservoir. Under contractual agreements between Reclamation and the Oakdale Irrigation District (OID) and South San Joaquin Irrigation District (SSJID), Tulloch Reservoir provides afterbay storage to re-regulate power releases from New Melones Powerplant. Approximately 1.9 miles downstream of Tulloch Dam is Goodwin Dam and Reservoir. Goodwin Dam, constructed by OID and SSJID in 1912, creates a re-regulating reservoir for releases from Tulloch Powerplant. Goodwin Reservoir is the main water diversion point for the Stanislaus River and includes diversions through two canals running north and south of the Stanislaus River for delivery to OID and SSJID. Water impounded behind Goodwin Dam may also be pumped into the Goodwin Tunnel for deliveries to the Central San Joaquin Water Conservation District and the Stockton East Water District. Goodwin Reservoir also provides releases to the lower mainstem Stanislaus River.

The operating criteria for New Melones Reservoir are governed by water rights, flood control, instream fish and wildlife requirements, Bay-Delta flow requirements, dissolved oxygen requirements, Vernalis water quality, and CVP contracts.

b. Proposed Operations from April 1, 2002 through March 31, 2004

(1) New Melones Dam and Reservoir. In WY 2002 through March 2004, Reclamation proposes to operate the New Melones Reservoir level to meet the needs of the CVP (i.e., water delivery to downstream water rights, flood control, D-1641, water quality standards, fish and wildlife protection, water supplies to CVP contractors, Vernalis water quality, recreation, etc.). Predicted end-of-water year storage for New Melones is 1.5 MAF for the 50% exceedence forecast and 1.3 MAF for the 90% exceedence forecast (2.4 MAF capacity). New Melones Dam releases pass through the New Melones Powerplant into the Stanislaus River where flows are re-regulated approximately 6 miles downstream by Tulloch Dam. Tulloch Dam releases pass through the Tulloch Powerplant into the Stanislaus River where flows are re-regulated approximately 1.9 miles downstream at Goodwin Dam.

Goodwin Reservoir serves as a forebay for the diversion of water to several irrigation districts and it also provides releases to the lower Stanislaus River. Diversions from Goodwin Reservoir include two canals running north and south of the Stanislaus River that serve water to the Oakdale Irrigation District and the South San Joaquin Irrigation District and include the Goodwin Tunnel that delivers water to the Central San Joaquin Water Conservation District and the Stockton East Water District.

(2) Minimum Instream Flows in the Lower Stanislaus River. In WY 2002 through March 2004, Reclamation proposes to operate New Melones Dam according to the NMIPO (refer to pages 29 –32 in the BA). AFRP flow volumes on the lower Stanislaus River, as part of the NMIPO, are determined based on the New Melones end of February storage plus forecasted March to September inflow as shown in the New Melones Interim Plan of Operations (NMIPO) (see table 1-3 and 1-4 in the BA). The AFRP volume is then initially distributed based on modeled AFRP distributions and patterns used in the NMIPO. The final AFRP flow distributions are determined based on Reclamation and FWS coordination and consultation with DFG.

The proposed flows for WY 2002 through March 2004 under the 50% exceedence forecast meet the AFRP flow recommendations. Under the 90% exceedence forecast flows would be reduced in all months with a significant reduction (from1500 to 870 cfs) occurring during the usual VAMP increases (April though May) and a low point in October of 129 cfs.

(3) Seasonal fluctuations and ramping of stream flows in the Stanislaus River. Reclamation has adopted, and is currently implementing, a modified ramping criteria developed for the Trinity River. The FWS first proposed using this approach until basin-specific criteria can be developed because the Stanislaus River has characteristics similar to the Trinity River. DFG is currently conducting a flow study to determine more appropriate specific criteria.

(4) Temperature control in the Stanislaus River. Reclamation does not actively manage temperatures on the lower Stanislaus River. In the 50% exceedence forecasts for 2002 through March 2004 mean monthly temperatures exceed 65°F only in one month, July, at Oakdale (the current upstream extent of suitable rearing habitat) based on proposed flow conditions. In the 90/75% exceedence forecasts March 2003 through March 2004 exceed 65°F at Oakdale during July and August.

(5) Monitoring Efforts on the Stanislaus River. Several monitoring efforts are underway on the Stanislaus River that are either partially or wholly funded through Reclamation. These efforts focus mainly on gathering information on Chinook salmon abundance, but indirectly collect steelhead information. Monitoring has consisted of rotary screw traps, snorkel surveys and redd counts conducted by DFG, Fisheries Foundation of California, and S.P. Cramer and Associates (SPCA). For WY 2002-2004, Reclamation has proposed using a resistance board weir, built by DFG to meet the monitoring requirements specified under the previous Opinion (SPCA 2002). This three year study was submitted by SPCA for CALFED funding and approved in April of 2002. Resistance board weirs have been proven effective in Alaska for providing direct, reliable counts of salmon and steelhead, which can be compared to escapement estimates to determine their accuracy.

B. Description of State Water Project Facilities Upstream of the Sacramento/San Joaquin Delta

1. Feather River Division (Oroville-Thermalito Complex)

a. Background

The Oroville-Thermalito Complex of the SWP includes facilities that conserve water on the Feather River for power generation, flood control, recreation, and fish and wildlife protection. The Oroville-Thermalito Complex includes the following: Oroville Dam and Lake (3.5 MAF capacity), and Edward-Hyatt Powerplant; Thermalito Diversion Dam, Power Canal, Diversion Pool, Diversion Dam Powerplant, Forebay and Afterbay; and the Fish Barrier Dam (see Figure 4 in BA). A maximum of 17,000 cubic feet per second (cfs) can be released from Oroville Dam through the Edward Hyatt Powerplant. Approximately four miles downstream from the Oroville Dam/Edward-Hyatt Powerplant is the Thermalito Diversion Dam. The Thermalito Diversion Dam creates the Thermalito Diversion Pool which acts as a water diversion point and includes diversions to the Thermalito Power Canal on the north side (majority of the flow; up to 17,000 cfs) and to the Feather River on the south side. This river section on the south side, the historical river channel, between the Thermalito Diversion Dam and the Thermalito Afterbay Outlet is commonly referred to as the low flow channel. Flows are typically a constant 600 cfs through this 8-mile low flow channel except during periods when flood control releases from Oroville Lake are in effect. The Fish Barrier Dam at the upstream end of the low flow channel is an impassable barrier that diverts water for use by the DFG's Feather River Fish Hatchery.

The Thermalito Power Canal hydraulically links the Thermalito Diversion Pool to the Thermalito Forebay (11,768 AF capacity; offstream regulating reservoir for the Thermalito Powerplant); water diverted at the Thermalito Diversion Dam travels through the Thermalito Power Canal and empties into the Thermalito Forebay. Water from the Thermalito Forebay exits through the Thermalito Powerplant into the Thermalito Afterbay and is either used by diverters directly from the Afterbay or is released back into the Feather River approximately 8 miles downstream of its original diversion point. Thermalito Afterbay provides for local diversions that can take up to 4,050 cfs during peak demands. In addition, excess water conserved in storage within the Thermalito Afterbay can be used for pumpback operations through both the Thermalito and Edward-Hyatt Powerplants when economically feasible. The Thermalito Diversion Pool serves as a forebay when the Edward-Hyatt Powerplant is pumping water back into Lake Oroville.

The August 1983 agreement between DWR and DFG Concerning the Operation of the Oroville Division of the State Water Project for Management of Fish & Wildlife sets criteria and objectives for flow and temperatures in the low flow channel and the reach of the Feather River between Thermalito Afterbay and Verona. This agreement establishes (1) minimum flows between Thermalito Afterbay Outlet and Verona which vary by water year type, (2) requires flow changes under 2,500 cfs to be reduced by no more than 200 cfs during any 24-hour period, except for flood control, failures, etc., (3) requires flow stability during the peak of the fall-run Chinook spawning season, and (4) sets an objective of suitable temperature conditions during the fall months for salmon and during the late spring/summer for shad and striped bass.

The COE flood control diagram (COE 1971) specifies flood control requirements and regulating criteria for Oroville Reservoir. From June 15 through September 15, no flood control restrictions exist. Full flood reservation space is required from November 17 through February 7. From September 16 through November 16 and from April 20 through May 31, reserved storage space for flood control is a function of the date. Beginning February 8 and continuing through April 20, flood reservation space is a function of both date and wetness.

b. Proposed Operations from April 1, 2002 through March 31, 2004

(1) Oroville-Thermalito Complex. In WY 2002 through March 2004, DWR proposes to operate the reservoir level to meet the needs of the SWP (i.e., water delivery to irrigation districts, flood control, power generation, recreation, D-1641 water quality standards, fish and wildlife protection, etc.). Flows are released from Oroville primarily through the Edward Hyatt Powerplant (17,000 cfs capacity) where most flows are then diverted through the Thermalito Power Canal and Powerplant (17,000 cfs capacity) with the exception of 600 cfs diverted to the low flow channel. The Edward Hyatt Powerplant and the Thermalito Powerplant are operated in tandem to maximize power generation. During periods of peak power demands, water releases in excess of local and downstream requirements are conserved in storage at Thermalito Forebay and are pumped back during off-peak hours through both Powerplants into Lake Oroville to generate additional power. Pumpback operations only occur when it is economically advantageous and commonly occurs during periods when energy prices are high during on-peak hours of the weekdays and low during the off-peak hours or on weekends.

Southern California Edison (SCE) has a contract with DWR for 35 to 45% of the Hyatt-Thermalito Complex power generation. Also as part of the contractual agreement, SCE may increase its generation potential by pumping back at night and generating during the day during periods when it is economically advantageous to use pumpback operations.

Predicted end-of-water year storage for Lake Oroville for the 50% forecast is 2.0 MAF and for the 90% forecast is 1.2MAF (3.5 MAF capacity).

(2) Feather River minimum streamflows. In WY 2002 through March 2004, DWR proposes to provide year-round monthly average flows of 600 cfs, under the 50% exceedence forecast, in the historical river channel (low flow channel) of the Feather River (Fish Barrier Dam to the Thermalito Afterbay Outlet), based upon criteria established in a 1983 agreement between DWR and DFG, *Concerning the Operation of the Oroville Division of the State Water Project for Management of Fish & Wildlife* (see Appendix B of the BA). The minimum flow requirement in the low flow channel is 600 cfs under this agreement. This 8-mile reach contains the known extent of spring-run Chinook salmon and steelhead spawning and rearing habitat on the Feather River.

In WY 2002 through March 2004, DWR also proposes to provide at least the minimum flow requirements that were established in this agreement for the reach of the Feather River between the Thermalito Afterbay and Verona under the 50% exceedence forecast. Minimum flow requirements between the Thermalito Afterbay and Verona vary for different times of the year, but can go as low as 750 cfs when storage falls below 1.5 MAF (see Appendix B of the BA). In the 90/75% exceedence forecast, releases are predicted to be less than 1,000 cfs December through March, and less than 1,750 cfs November through March in the 50% exceedence forecast. Currently, the SWP has been releasing a minimum flow of 1,200 cfs since October, 2001 and expects to continue releasing that amount until April 2002.

(3) Feather River seasonal fluctuations and ramping of stream flows. DWR did not propose any ramping criteria for Oroville releases within the low flow channel. According to the 1983 agreement between DWR and DFG (see Appendix B of the BA), when flows below Thermalito Afterbay are less than 2500 cfs, they can not be reduced more than 200 cfs during any 24-hour period, except for flood control releases, failures, etc.

(4) Feather River temperature control. In WY 2002 through March 2004, DWR proposes to meet the temperature criteria that were established in the 1983 agreement between DWR and DFG (see Appendix B of the BA). Varying temperature criteria were specified in the agreement for two different locations within the Feather River; the Feather River Hatchery (FRH) and the reach of the Feather River between the Thermalito Afterbay and Verona. Criteria for the FRH were specified to provide suitable temperatures within the hatchery for raising Chinook salmon and steelhead. The hatchery is located at the upstream end of the low flow channel, therefore temperatures within the low flow channel are influenced by the FRH temperature requirements. Temperature criteria between Thermalito and Verona were specified to provide suitable temperatures during the fall months (after September 15) for fall-run Chinook salmon and suitable temperatures from May through August for shad, striped bass, etc.

For the 50% and 90/75% exceedence forecast, monthly average temperatures are predicted to be less than 56°F within the low flow channel from September through May. In the 50% forecasts monthly average temperatures predicted at the downstream end of the low flow channel for May and September is no greater than 63.8°F. Predicted monthly average temperatures at the downstream end of the low flow channel for June through August range from 65.3°F to 68.5°F. In the 90/75% exceedence forecast monthly average temperatures predicted at the downstream end of the low flow channel for May and September are 63°F and 66°F, respectively, and June through August range from 67.1°F to 71.8°F.

C. Description of Central Valley Project and State Water Project Facilities within the Sacramento/San Joaquin Delta

The CVP and SWP use the Sacramento and San Joaquin Rivers and channels in the Delta to transport natural river flows and reservoir storage to two large water export facilities in the south Delta. The CVP Tracy Pumping Plant and the SWP Harvey O. Banks Delta Pumping Plant

(Banks Pumping Plant) are operated to meet the water supply needs in the San Joaquin Valley, Southern California, central coast, and south San Francisco Bay area.

SWRCB decisions and orders largely determine delta operations of CVP and SWP facilities. Reclamation and DWR currently operate CVP and SWP facilities in coordination with the water export facilities in the south Delta to comply with the terms and conditions of SWRCB Decision 990, Decision 1291, Decision 1485, and Order WR 95-6. Order WR 95-6 had the effect of temporarily making the CVP and SWP water rights consistent with their voluntary compliance of the objectives in the 1995 Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary. On December 3, 1998, the SWRCB adopted Order WR 98-09 which temporarily extended Order WR 95-6, as modified, until adoption of a comprehensive water rights decision that allocates final responsibility for meeting 1995 Bay-Delta objectives or December 31, 1999, whichever came first. On December 29, 1999, the SWRCB adopted Decision 1641 (D-1641). D-1641 implements flow objectives for the Bay-Delta Estuary, approves a petition to change points of diversion of the CVP and SWP in the southern Delta, and approves a petition to change places of use and purposes of use of the CVP.

Operations of the CVP reflect actions taken in accordance with provisions of the CVPIA, particularly sections 3406(b)(1), (b)(2), and (b)(3). The DOI Final Decision combined with the May 1997 AFRP Plan provide the basis for implementing upstream and Delta fish actions with CVP yield. The FWS has identified actions that contribute to the CVPIA goal of doubling the natural production of anadromous fish and FWS anticipates selecting actions from this list for the annual management of the 800 TAF of CVP yield dedicated under (b)(2). Not all the actions on this list will be implemented in any given year, but instead FWS will annually select the appropriate actions for use of (b)(2) water supplies based on biological needs, hydrologic circumstances, and water availability. To assist Reclamation and FWS in the accounting methodology, and the procedures for management and implementation of annual actions with (b)(2) water supplies, Interior has established a B2 Interagency Team (B2IT) consisting of representatives from DWR, DFG, Reclamation, FWS, NOAA Fisheries, and WAPA.

WY 2002 includes the second year of implementation of the Environmental Water Account (EWA) as specified in the CALFED Framework Agreement, dated June 9, 2000. This agreement sets aside 380 TAF of water purchases and groundwater storage to assure the effectiveness of the EWA to protect endangered fish species. The management agencies, NOAA Fisheries, DFG, and FWS, are charged with managing these assets in coordination with project operators, Water Operations Management Team (WOMT), and the CALFED Operations Group. To date through the *Provisional Juvenile Salmon Decision Process*, the EWA has been used to protect juvenile spring-run Chinook salmon and steelhead in the Delta and adult steelhead spawning in the American River.

1. CVP Export Facilities and Associated Tracy Fish Collection Facility

a. Background

The Tracy Pumping Plant, about five miles north of Tracy, California, consists of six pumps including one rated at 800 cfs, two at 850 cfs, and three at 950 cfs. Although the total plant capacity is about 5,300 cfs, the maximum permitted pumping capacity by the State Water Resources Control Board (SWRCB) is 4,600 cfs. The Tracy pumping plant is located at the end of an earth-lined intake channel about 2.5 miles long and pumps water from Old River into the Delta-Mendota Canal. A portion of the water conveyed through the Delta-Mendota Canal flows into the O'Neill Forebay and is lifted to the joint CVP/SWP San Luis Reservoir for storage.

At the head of the intake channel, the Tracy Fish Collection Facility is designed to intercept fish before they pass through the canal to the Tracy Pumping Plant. Fish are collected and transported by tanker truck to release sites away from the pumps. This facility uses behavioral barriers consisting of primary and secondary louvers to guide targeted fish into holding tanks. When compatible with export operations, the louvers are operated with the objective of achieving water approach velocities: for striped bass of approximately one foot per second from May 15 through October 31, and for salmon of approximately three feet per second from November 1 through May 14. Channel velocity criteria are a function of bypass ratios through the facility. Hauling trucks are used to transport salvaged fish to release sites in the western Delta. The CVP maintains two permanent release sites: one on the Sacramento River near Horseshoe Bend and the other on the San Joaquin River immediately upstream of Antioch Bridge.

b. Proposed Operations from April 1, 2002 through March 31, 2004

Reclamation proposes to operate the Tracy Pumping Plant (TPP) and TFCF in compliance with SWRCB D-1641, WRO, FWS 1995 biological opinion for delta smelt, CALFED Operations Group, the October 1 through January 31, 2001 *Provisional Fall/Winter Juvenile Salmon Decision Process* (formerly known as the Spring-run Protection Plan), the *February through March Salmon Decision Process* (revised March 8, 2001) and the DOI Final Decision (management of (b)(2) flows for fish and wildlife). The TPP will typically operate at or near its maximum rate of 4,600 cfs except during periods of low Delta inflow, curtailments for the *Juvenile Salmon Decision Process*, implementation of CVPIA (b)(2) fisheries actions, or curtailments for water quality exceedence.

The *Provisional Fall/Winter Juvenile Salmon Decision Process* establishes a set of criteria based on real-time monitoring as a requirement of the WRO and SWRCB (Water Quality Control Plan Decision 1641) for the Delta. These criteria were established to protect juvenile spring-run and winter-run Chinook as they passed through the Delta. The later *February through March Salmon Decision Process* protects steelhead smolts and young-of-the-year (YOY) spring-run Chinook. These criteria or fish triggers control when the Delta Cross Channel gates are closed and when exports are reduced at the Delta pumping facilities.

The TFCF will be operated to intercept fish before they pass through the canal to the TPP. Fish passing through the facility will be sampled at intervals of no less than 10 minutes every 2 hours. Fish observed during sampling intervals will be identified to species, measured to fork length, examined for marks or tags, and placed in the collection facilities for transport by tanker truck to release sites away from the pumps. All other fish that enter the facility will be collected and transported by tanker truck to Delta release sites away from the pumps. To the extent possible, the louvers of the fish collection facility will be operated to meet water approach velocities established for salmon of approximately three feet per second from November 1 through May 14.

Reclamation recognizes that Delta export operations must be coordinated with other actions and programs in the Delta and Central Valley. Through the CALFED Operations Group (CALFED-Ops), Data Assessment Team (DAT), and Water Operations Management Team (WOMT), NOAA Fisheries and the other CALFED agencies will be updated weekly on CVP operations and participate in decisions which involve change in export rates, temporary barrier operations, or reservoir releases. The CALFED Operations Group will also serve to distribute information regarding CVPIA (b)(2) and EWA water actions.

2. SWP Export Facilities, Clifton Court Forebay, and associated Skinner Fish Protection Facility

a. Background

The Banks Pumping Plant, about eight miles northwest of Tracy, California in the south Delta, consists of 11 pumps, including two rated at 375 cfs, five at 1,130 cfs, and four at 1,067 cfs. Water is pumped from the Clifton Court Forebay (CCF) through the Banks Pumping Plant into the California Aqueduct, which has a nominal capacity of 10,300 cfs. Average daily pumping at the Banks Pumping Plant is constrained by diversion limitations at CCF. Water in the California Aqueduct flows to O'Neill Forebay, from which a portion of the flow is lifted to the joint CVP/SWP San Luis Reservoir for storage. From O'Neill Forebay, the joint-use portion of the aqueduct, San Luis Canal, extends south to the southern end of the San Joaquin Valley. The SWP portion of the aqueduct continues over the Tehachapi Mountains to the South Coast Region.

The CCF is a regulated reservoir at the head of the California Aqueduct in the south Delta. Delta water inflows to the Forebay are controlled by radial gates, which are generally operated during the tidal cycle to reduce approach velocities, prevent scour in adjacent channels, and minimize water level fluctuation in the south Delta by taking water in through the gates at times other than low tide. When a large head differential exists between the outside and inside of the gates, theoretical inflow can be as high as 15,000 cfs for a short period of time. However, existing operating procedures identify a maximum design rate of 12,000 cfs, which prevents water velocities from exceeding three feet per second to control erosion and prevent damage to the facility.

In front of the Banks Pumping Plant, the Skinner Fish Protection Facility (SFPF) intercepts fish, which are collected and transported by tanker truck to release sites away from the pumps. This facility uses behavioral barriers consisting of primary and secondary louvers to guide targeted fish into holding tanks for subsequent transport by truck to release sites within the Delta. When compatible with export operations, the louvers are operated with the objective of achieving water approach velocities: for striped bass of approximately 1 foot per second from May 15 through October 31, and for salmon of approximately three feet per second from November 1 through May 14. Channel velocity criteria are a function of bypass ratios through the facility. Hauling trucks are used to transport salvaged fish to release sites. The SWP maintains two permanent release sites: one at Horseshoe Bend on the Sacramento River and the other on Sherman Island at Curtis Landing on the San Joaquin River.

b. Proposed Operations from April 1, 2002 through March 31, 2004

DWR proposes to operate the Banks Pumping Plant and Skinner Fish Protection Facility in compliance with SWRCB D-1641, WRO, FWS 1995 biological opinion for delta smelt, the October 1 through January 31, 2001 *Provisional Fall/Winter Juvenile Salmon Decision Process,* and the *February though March Juvenile Salmon Decision Process*. The 2002-2004 DWR operations plan includes implementing Delta and upstream reservoir CVPIA (b)(2) actions as described in the November 20, 1997, Final Administrative Proposal on the Management of Section 3406(b)(2) water, in a manner that reduces potential water supply impacts on Delta actions. Although this Administrative Proposal has been subsequently superceded by the October 6, 1999, DOI Final Decision, the fisheries protection actions are basically the same, and a process to facilitate implementation and ensure that (b)(2) actions do not adversely affect the SWP remains in place. DWR recognizes that (b)(2) actions in the Delta cannot be successfully implemented without the coordination and cooperation of the SWP and thus, DWR remains fully engaged in the process to coordinate operations and develop tools to avoid or minimize water supply impacts.

In December 2000 the CALFED ROD was completed, creating the EWA to be used in conjunction with the CVPIA (b)(2) actions to protect endangered fish species. For purposes of this consultation, use of the EWA has only been described in the forecasting and in the *Provisional Fall/Winter Juvenile Salmon Decision Process* (dated November 14, 2000). In WY 2002 EWA actions were taken to curtail exports during key fish migration intervals with most of the EWA cost being applied to the SWP while (b)(2) actions were applied to the CVP.

The Banks Pumping Plant will operate up to its maximum permitted rate of 6,680 cfs except during periods of low Delta inflow, curtailments for the *Provisional Fall/Winter Juvenile Salmon Decision Process*, implementation of CVPIA (b)(2) Fisheries actions, curtailments for water quality exceedence, or reduced demand. During the period between December 15 and March 15, the Banks Pumping Plan may operate above 6,680 cfs to export one-third of the total flow of the San Joaquin River as measured at Vernalis when its total flow exceeds 1,000 cfs. Under the 50% exceedence forecast, DWR forecasts the SWP share of San Luis Reservoir will be filled in late

March 2002 and any EWA water accumulated through relaxation of the export-to-inflow (E/I) ratio would begin to spill. Under the 90% and 75% exceedence forecast, the SWP share of San Luis Reservoir is never filled in 2002 and EWA water remains available to meet fishery impacts to South of Delta water users. Upon filling the SWP portion of San Luis Reservoir, DWR predicts pumping at Banks will be reduced to a lower level to support exports for CVP Cross Valley supplies and delivery of an undetermined amount of interruptible supplies (Article 21 water) to SWP contractors.

The Skinner Fish Protection Facility will be operated to intercept fish before they pass down the California Aqueduct to the Banks Pumping Plant. Fish passing through the facility will be sampled at intervals of no less than 10 minutes every 2 hours. Fish observed during sampling intervals will be identified to species, measured to fork length, examined for marks or tags, and placed in the collection facilities for transport by tanker truck to release sites away from the pumps. All other fish passing through the facility will be collected and transported by tanker truck to Delta release sites away from the pumps. To the extent possible, the louvers of the fish collection facility will be operated to meet water approach velocities established for salmon of approximately three feet per second from November 1 through May 14.

DWR also recognizes that Delta export operations must be coordinated with other actions and programs in the Delta and Central Valley. Through the CALFED-OPS, WOMT, and DAT meetings, NOAA Fisheries and the other CALFED agencies will be updated weekly on SWP Delta operations and participate in decisions which involve change in export rates, temporary barrier operations, or reservoir releases. The CALFED Operations Group will also serve to distribute information regarding CVPIA (b)(2) and EWA water actions.

Through the CALFED Operations Group, NOAA Fisheries and the other CALFED agencies will be updated monthly on DWR's Delta operations and participate in decisions which involve any change in export rates, barrier operations, or reservoir releases.

3. San Luis Reservoir Storage

Based on the February 15, 2002 forecast, a summary of Delta water export operations and San Luis Reservoir storage from January through December 2002, under a 90% exceedence forecast and 50% exceedence forecast are presented in Tables 1 and 2, respectively. Under the 90% exceedence forecast, Reclamation and DWR propose to export approximately 1.08 MAF of water and total San Luis Reservoir storage will reach approximately 1.89 MAF at the end of February, 2002. Under the 50% exceedence forecast, Reclamation and DWR propose to export 1.45 MAF and total San Luis Reservoir storage will fill at approximately 2.02 MAF at the end of February.

Table 1. Delta Operations Summary and San Luis Storage (TAF) under 90% Exceedence Forecast with EWA and (b)(2) for WY 2002 - 2003.

	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan
Tracy Export	191	198	102	95	178	280	280	250	259	135	164	208
Fed @Banks						24	48					
Contra Costa Export	14	14	13	13	13	10	11	13	17	17	18	18
State Export	200	148	95	89	142	274	273	320	175	193	169	144
Total Export	405	360	210	197	333	588	612	583	451	345	351	370
% E/I Divert.	31	31	20	19	33	50	53	58	52	49	50	46
Fed SL Stor.	957	967	848	648	687	229	104	128	234	279	383	529
State SL Stor	936	898	747	571	426	251	161	283	300	347	368	394
Total SL Stor	1893	1865	1595	1219	1113	480	265	411	534	626	751	923

Table 2. Delta Operations Summary and San Luis Reservoir Storage (TAF) under a 50% Exceedence Forecast with EWA and (b)(2) WY 2002 - 2003.

	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan
Tracy Export	190	199	127	131	178	280	280	251	259	251	258	258
Fed @ Banks									34	34		
Contra Costa Export	14	14	13	13	13	10	11	13	17	17	18	18
State Export	290	145	160	52	161	417	417	405	213	317	421	380
Total Export	494	358	300	196	352	707	708	669	523	619	697	656
Excess Outflow (cfs)	20876	10853	3315	2068	834						8986	7996
% E/I Divert.	22	14	18	14	29	51	55	61	58	67	45	45
Fed SL Stor.	962	962	961	797	501	233	157	204	297	447	625	806
State SL Stor	1065	1065	1065	874	573	311	100	163	186	202	426	751
Total SL Stor	2027	2027	2026	1671	1074	544	256	367	483	649	1051	1557

Under the 90% and 75% exceedence forecast, the export-to-inflow (E/I) ratios remain near or under the maximum rate permitted by the SWRCB under D-1641. The Federal portion of San Luis storage fills and encroaches (approximately 1 TAF) upon the SWP share which never fills. Combined exports are high July through September and in December and January (> 6,000 cfs).

Under the 50% exceedence forecast, the E/I ratio remains significantly below the maximum rate permitted by D-1641 in all months and DWR fills the SWP share of San Luis storage in March. Upon filling the SWP share of San Luis storage, SWP exports are reduced considerably during January, February, and March. Reclamation fills the CVP share of San Luis storage under the 50% exceedence forecast in January. Combined exports in both 2003 and 2004 are over 10,000 cfs July through October and January through February.

4. North Bay Aqueduct Intake at Barker Slough

a. Background

The SWP uses the North Bay Aqueduct intake at Barker Slough to divert water from the north Delta near Cache Slough for agricultural and municipal uses in Napa and Solano counties. Maximum pumping capacity is about 175 cfs. Daily pumping rates typically range from 20 to 130 cfs. The intake has a positive barrier fish screen consisting of a series of flat, stainless steel, wedge-wire panels with a slot width of 3/32 inch. The facility is operated to maintain a screen approach velocity of no greater than 2 feet per second.

b. Proposed Operations from April 1, 2002 through March 31, 2004

DWR proposes to operate the North Bay Aqueduct intake in the range from 30 to 140 cfs. Project deliveries during 2002 are expected to be no more than 27 TAF in the 90% exceedence forecast and 42 TAF in the 50% exceedence forecast. However, if DWR were to deliver the full contracted amount, deliveries could be as high as 70 TAF. This facility is currently screened to prevent entrainment of juvenile salmonids and is located ten miles from the mainstem Sacramento River.

5. Delta Cross Channel

a. Background

The Delta Cross Channel (DCC) is a controlled diversion channel located in the northern Delta between the Sacramento River and Snodgrass Slough, a tributary of the Mokelumne River. Reclamation operates the DCC to improve the transfer of water from the Sacramento River to the central Delta and export facilities at the Banks and Tracy pumping plants. To reduce scour in the channels on the downstream side of the DCC gate and to reduce potential flood flows that might occur from diverting water from the Sacramento River into the Mokelumne River system, the gates are closed whenever flows in the Sacramento River at Freeport reach 25,000 to 30,000 cfs on a sustained basis. Flows through the gates are determined by Sacramento River stage and are not affected by export rates in the south Delta. Pursuant to the WR Opinion and the SWRCB Water Quality Control Plan, the DCC gates are generally closed from February 1 through May 20 for the protection of emigrating juvenile salmon.

b. Proposed Operations from April 1, 2002 through March 31, 2004

Gate operation will occur in accordance with the CALFED OPS - *Provisional Fall/Winter Juvenile Salmon Decision Process*. This plan was developed by DWR and Reclamation with the assistance of the CALFED OPS to comply with the California Fish and Game Commission Special Order related to spring-run Chinook incidental take authorization under the California Endangered Species Act (CESA). This plan includes monitoring of juvenile salmon movements in the lower Sacramento River and Delta, data assessment procedures, specific indicators of spring-run Chinook vulnerability to impacts from Delta pumping, and operation responses to minimize the effects of Delta export pumping. Three specific indicators are presented in the plan: (1) First Alert requires the DAT to analyze and report the results of fisheries monitoring programs; (2) Second Alert requires the closure of the DCC gates for specific periods of time dependant on the Sacramento River Catch Index; and (3) DAT recommends export curtailments in five day increments to WOMT, dependant on fish salvage and loss results at the CVP/SWP facilities. Whether or not exports are reduced and to what degree depend upon the amount of EWA assets available for that month. Exports can only be reduced if there is no impact to the CVP/SWP. The WOMT is made up of agency management, including NOAA Fisheries, who weekly review the availability and priority regarding the use of EWA and (b)(2) water to compensate for curtailments.

The DCC gates can be closed by Reclamation for the protection of fish, provided that water quality is not a concern in the Central or South Delta. In all years from February 1 through May 20, the SWRCB Water Quality Control Plan (D-1641) requires that the DCC gates remain closed for the protection of emigrating juvenile salmon in the Sacramento River. An optional closure up to 45 days can be requested during the November through January period, after consultation with NOAA Fisheries, FWS and DFG determines it is necessary. In addition, D-1641 requires the DCC gates to be closed for a total of 14 days during the May 21 through June 15 period.

6. Suisun Marsh Salinity Control Gates

a. Background

The Suisun Marsh Salinity Control Gates (SMSCG) are located about 2 miles northwest of the eastern end of Montezuma Slough, near Collinsville. The SMSCG, which span the entire 465 foot width of Montezuma Slough ,include permanent barriers adjacent to the levee on each side of the channel, flashboards, radial gates, and a boat lock. The structure is typically operated from

September through May to tidally pump lower salinity water from Collinsville through Montezuma Slough into the eastern and central portion of Suisun Marsh. The SMSCG also serve to retard the movement of higher salinity water from Grizzly Bay into the western marsh. During full gate operation, the SMSCG open and close twice each tidal day. During ebb tides, the gates are open to allow the normal flow of lower salinity water from the Sacramento River to enter Montezuma Slough. During flood tides, the gates are closed to retard the upstream movement of higher salinity water from Grizzly Bay.

b. Proposed Operations from April 1, 2002 through March 31, 2004

DWR may operate the SMSCG during the period covered under this opinion from April 1, 2002, through March 31, 2004, but will only operate the SMSGC as needed to meet SWRCB and Suisun Marsh Preservation Agreement water quality standards. The non-operation configuration of the SMSCG during this period typically consists of the flashboards installed, but the radial gate operation is stopped and held open. Flashboards will be removed if it is determined that salinity conditions at all trigger stations would remain below standards for the remainder of the control season through May 31.

Testing of gate operations to allow for greater adult salmon and steelhead passage without delays will continue in 2002 and 2003. Results from last year determined that slots in the gates did not result in increasing passage. Operations of the gates in 2003 will focus on the use of the boat lock to increase adult passage.

7. Rock Slough Pumping Plant

a. Background

The Contra Costa Canal was built by Reclamation in 1948 and is currently operated by the Contra Costa Water District (CCWD). The Canal uses an unscreened intake facility at Rock Slough about four miles southeast of Oakley to divert water from the Delta for agricultural, municipal and industrial uses in central and northeastern Contra Costa County. The Rock Slough intake consists of four pumping plants that lift diverted water 127 feet into the Contra Costa Canal. This 47.7 mile long canal terminates into Martinez Reservoir. In addition, two short canals called Clayton and Ygnacio are integrated into the distribution system. Rock Slough has a diversion capacity of 350 cfs, which gradually decreases to 22 cfs at the terminus.

Prior to 1997, Rock Slough was the primary diversion facility for CCWD in the Delta and pumping ranged from 50 to 250 cfs with seasonal variation. In 1997, CCWD began additional diversions from the Delta at a new 250 cfs screened intake structure on Old River, which is part of the recently completed Los Vaqueros Project. The Old River facility allows CCWD to directly divert up to 250 cfs of CVP water into an intertie with the existing Contra Costa Canal, which allows for reduced diversion needs at Rock Slough. In addition, the Old River facility can divert up to 200 cfs of CVP and Los Vaqueros water rights for storage into the new 100 TAF Los Vaqueros Reservoir.

Pursuant to the 1993 FWS delta smelt biological opinion for Los Vaqueros (Los Vaqueros Opinion), the Old River Facility is now the primary diversion point for CCWD during January through August of each year. Additionally, according to the Los Vaqueros Opinion and the WRO, CCWD is required to cease all diversions from the Delta for 30 days during the spring if stored water is available for use in Los Vaqueros above emergency storage levels. These operations criteria are designed to provide protection to Delta fisheries.

b. Proposed Operations from April 1, 2002 through March 31, 2004

Reclamation proposes that CCWD will operate the Contra Costa Canal and Rock Slough intake to divert less than 18 TAF per month for a total of 171 TAF in WY 2002. Under the 50% and the 90% exceedence forecasts (dated February 15, 2002) the total water diverted remains the same in each month. CCWD diversions for 2003 and 2004 were not forecasted in the BA, but are expected to remain similar to 2002. In general, total diversions from the Delta for CCWD will be reduced in drier periods when water quality and flows are low.

8. <u>SWP Delta Pumping Plant Fish Protection Agreement (Four-Pumps Agreement)</u>

Pursuant to the December 30, 1986, SWP Delta Pumping Plant Fish Protection Agreement (Four-Pumps Agreement), DWR and DFG have approved four projects for continued funding in WY 2002-2003 that include quantifiable benefits to Central Valley spring-run Chinook salmon and steelhead. Three of the four projects have been implemented and are on-going. These four projects are: (1) enhanced law enforcement efforts in Mill, Deer, Antelope, Butte, Big Chico, Cottonwood and Battle Creeks to deter poaching and the Delta-Bay Enhanced Enforcement Program (DBEEP) covering San Francisco Bay upstream into the Sacramento and San Joaquin tributaries; (2) construction of fish screens and ladders on Butte Creek, Durham Mutual, and Parrot Phelan diversions; (3) Mill and Deer Creek Water Exchange projects to switch irrigation from stream diversions to groundwater; and 4) spawning habitat enhancement projects on the San Joaquin tributaries. The Mill Creek project was completed in 1992 and has been funded annually at approximately $35,000 per year. A pilot project for Deer Creek, using two of the ten pumps proposed, is scheduled for completion in 2003 at an estimated cost of approximately $40,000 per year.

III. STATUS OF THE SPECIES

Central Valley spring-run Chinook salmon (*O. tshawytscha*) are listed as threatened under the ESA (September 16, 1999, 64 FR 50394). This ESU consists of spring-run Chinook salmon occurring in the Sacramento River Basin. Designated critical habitat for CV spring-run Chinook salmon includes all river reaches accessible to listed Chinook salmon in the Sacramento River and its tributaries in California, except for reaches on Indian tribal lands. Also included are river reaches and estuarine areas of the Sacramento-San Joaquin Delta, all waters from Chipps Island westward to Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and Carquinez Strait, all waters of San Pablo Bay westward of the Carquinez Bridge, and all waters of San Francisco Bay (north of the San Francisco/Oakland Bay Bridge) from San Pablo Bay to the Golden Gate Bridge. This critical habitat designation includes all waterways, substrate, and adjacent riparian zones. Excluded are: (1) areas above specific dams identified in the Federal Register notice; (2) areas above longstanding, natural impassable barriers (i.e., natural waterfalls in existence for at least several hundred years); and (3) Indian tribal lands (February 16, 2000, 65 FR 7764).

Central Valley (CV) steelhead (*O. mykiss*) are listed as threatened under the ESA (March 19, 1998, 63 FR 13347). This ESU consists of steelhead populations in the Sacramento and San Joaquin River Basins in California's Central Valley. Designated critical habitat for CV steelhead includes all river reaches accessible to listed steelhead in the Sacramento and San Joaquin rivers and their tributaries in California, except for reaches on Indian tribal lands. Also included are river reaches and estuarine areas of the Delta, all waters from Chipps Island westward to Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and Carquinez Strait, all waters of San Pablo Bay westward of the Carquinez Bridge, and all waters of San Francisco Bay (north of the San Francisco/Oakland Bay Bridge) from San Pablo Bay to the Golden Gate Bridge. Excluded are: (1) areas above specific dams identified in the Federal Register notice; (2) areas above longstanding, natural impassable barriers (i.e., natural waterfalls in existence for at least several hundred years); (3) Indian tribal lands; and (4) areas of the San Joaquin River upstream of the Merced River confluence (February 16, 2000, 65 FR 7764).

Following are brief descriptions of the general life histories and population trends of these two species.

A. Chinook Salmon

1. General Life History

Chinook salmon historically ranged from the Ventura River in southern California north to Point Hope, Alaska, and in northeastern Asia from Hokkaido, Japan to the Anadyr River in Russia (Healey 1991). Of the Pacific salmon, Chinook salmon exhibit two generalized freshwater life-history types. Healey (1991) described these as (1) the *stream-type* Chinook salmon which reside in freshwater for a year or more following emergence, and (2) the *ocean-type* Chinook salmon which migrate to the ocean within their first year.

Chinook salmon mature between 2 and 6+ years of age (Myers et al. 1998). Freshwater entry and spawning timing, are generally thought to be related to local water temperature and flow regimes

(Miller and Brannon 1982). Runs are designated on the basis of adult migration timing; however, distinct runs also differ in the degree of maturation at the time of river entry, thermal regime and flow characteristics of their spawning site, and actual time of spawning (Myers et al. 1998). Spring-run Chinook salmon tend to enter freshwater as immature fish, migrate far upriver, hold and finally spawn in the late summer and early autumn. Historically, spring-run adults ascended to higher elevation reaches than any other race of salmon, to over-summer and avoid the excessive summer temperatures of the valley floor. For comparison fall-run Chinook salmon enter freshwater at an advanced stage of maturity, move rapidly to their spawning areas on the mainstem or lower tributaries of the rivers, and spawn within a few days or weeks of freshwater entry (Healey 1991).

Central Valley spring-run Chinook salmon adults are estimated to leave the ocean and enter the Sacramento River from March to July (Myers et al. 1998). Based on observations of spring-run Chinook salmon immigration in the Sacramento River, spring-run adults are likely to migrate upstream during the period between March and July into the Feather River where they hold below the hatchery fish barrier until spawning begins in mid- to late August. Most pre-spawning spring-run Chinook salmon adults hold in the upper three miles of the low flow channel (DWR and Reclamation 2000). Spring-run Chinook spawning typically occurs between late-August and early October with a peak in September. Spawning typically occurs in gravel beds that are located at the tails of holding pools (FWS 1995). Eggs are deposited within the gravel where incubation, hatching, and subsequent emergence takes place. The upper preferred water temperature for spawning adult Chinook salmon is 55°F (Chambers 1956) to 57°F (Reiser and Bjornn 1979). Length of time required for eggs to develop and hatch is dependent on water temperature and is quite variable. In Butte and Big Chico creeks, emergence of spring-run Chinook salmon typically occurs from November through January. In Mill and Deer creeks, colder water temperatures delay emergence to January through March (DFG 1998).

Post-emergent fry seek out shallow, near shore areas with slow current and good cover, and begin feeding on small terrestrial and aquatic insects and aquatic crustaceans. In Deer and Mill creeks, juvenile spring-run Chinook salmon usually spend 9-10 months in their natal streams, although some may spend as long as 18 months in freshwater. Most yearling spring-run Chinook salmon move downstream in the first high flows of the winter from November through January (FWS 1995; DFG 1998). In Butte and Big Chico creeks, spring-run juveniles typically exit their natal tributaries soon after emergence during December and January, although some remain throughout the summer and exit the following fall as yearlings. In the Sacramento River and other tributaries, juveniles may begin migrating downstream almost immediately following emergence from the gravel with emigration occurring from December through March (Moyle et al. 1989; Vogel and Marine 1991). Fry and parr may spend time rearing within riverine and/or estuarine habitats including natal tributaries, the Sacramento River, non-natal tributaries to the Sacramento River and the Delta. Non-natal rearing of spring-run juveniles has been observed in the lower part of tributaries and intermittent streams during the winter months (Maslin 1997 and Snider 2001).

Some YOY spring-run Chinook salmon will emigrate from the upper Sacramento Basin to presumably rear in the lower Sacramento River and Delta during December through May. The extent of the YOY population, which enters the Delta during this period, depends on their natal stream and specific hydrologic conditions. For example, the bulk of the juvenile production in Butte and Big Chico creeks is thought to emigrate as YOY from their natal tributaries from December through February (DFG 2000). Stream flow and/or turbidity increases in the upper Sacramento River Basin are thought to stimulate emigration.

Chinook salmon spend between one and four years in the ocean before returning to their natal streams to spawn (Myers et al.1998). Fisher (1994) reported that 87 percent of returning spring-run adults are three-years-old, based on observations of adult Chinook salmon trapped and examined at Red Bluff Diversion Dam between 1985 and 1991.

2. Population Trends - Central Valley Spring-run Chinook salmon

Historically, spring-run Chinook salmon were predominant throughout the Central Valley, occupying the upper and middle reaches of the San Joaquin, American, Yuba, Feather, Sacramento, McCloud, and Pit rivers, with smaller populations in most other tributaries with sufficient habitat for over-summering adults (Stone 1874; Rupture 1904; Clark 1929). The Central Valley drainage as a whole is estimated to have supported spring-run Chinook salmon runs as large as 600,000 fish between the late 1880s and 1940s (DFG 1998). Before the construction of Friend Dam, nearly 50,000 adults were counted in the San Joaquin River (Fry 1961). Following the completion of Friant Dam, the native population from the San Joaquin River and its tributaries (i.e., Stanislaus River) was extirpated. Spring-run Chinook salmon no longer exist in the American River due to the existence and operation of Folsom Dam.

Natural spawning populations of CV spring-run Chinook salmon are currently restricted to accessible reaches in the upper Sacramento River, Antelope Creek, Battle Creek, Beegum Creek, Big Chico Creek, Butte Creek, Clear Creek, Deer Creek, Feather River, Mill Creek, and Yuba River (DFG 1998; FWS, unpublished data). With the exception of Butte Creek and the Feather River, these populations are relatively small ranging from a few fish to several hundred. Butte Creek returns in 2000 and 2001 numbered approximately 4,118 and 9,605, respectively (DFG, 2002 unpublished data). On the Feather River, significant numbers of spring-run Chinook salmon, as identified by run timing, return to the FRH. In 2001, FRH reported 2,468 returning spring-run Chinook salmon, which is 52% below the 10-year average of 4,727 fish. However, coded-wire-tag (CWT) information from these hatchery returns indicates substantial introgression has occurred between fall-run and spring-run Chinook salmon populations in the Feather River due to hatchery practices.

Since 1970 total run size for the Central Valley has ranged between 3,044 and 33,711 adults for the following streams: Sacramento River mainstem, Battle Creek, Clear Creek, Cottonwood Creek, Antelope Creek, Mill Creek, Deer Creek, Big Chico Creek, Butte Creek, and the Feather River (DFG 2002 unpublished). Comparing ten-year averages for the same streams it would appear the population is stable, 11,986 in the 1970s, 15,221 in the 1980s, and 10,226 in the 1990s. However, since the late 1980s, the influence of the FRH has offset the decline on the mainstem Sacramento River. In 2001 the total run size for the above mentioned streams was 15,794 adults, well above the ten year average for the 1990s.

Additional historical information on Chinook salmon abundance are summarized in (Myers et al. 1998) and the recently published, *Contributions to the Biology of Central Valley Salmonids*, Fish Bulletin 179, Volumes 1 and 2, edited by Randall Brown (DFG 2001). Fish Bulletin 179 contains 17 selected papers on the most current CV salmon and steelhead research, population trends, survival to the Delta, ocean fishery management, recent findings, and historical accounts. Much of the information in the BA and this opinion draw from these papers. The factors contributing to the decline of CV spring-run Chinook salmon are discussed in the Environmental Baseline section below.

B. Steelhead

1. <u>General Life History</u>

Steelhead exhibit perhaps the most complex suite of life history traits of any species of Pacific salmonid. They can be anadromous or freshwater resident. Resident forms are usually called rainbow trout. Winter steelhead generally leave the ocean from August through April, and spawning occurs between December and May (Busby et al. 1996), peak spawning is likely to occur from January through March in the Sacramento River Basin. The timing of upstream migration is generally correlated with higher flow events and associated lower water temperatures. Unlike Pacific salmon, steelhead are iteroparous, or capable of spawning more than once before death (Busby et al. 1996). However, it is rare for steelhead to spawn more than twice before dying; most that do so are females (Busby et al. 1996; Nickelson et al. 1992). Iteroparity is more common among southern steelhead populations than northern populations (Busby et al. 1996).

Steelhead spawn in cool, clear streams featuring suitable gravel size, depth, and current velocity. Intermittent streams may be used for spawning (Barnhart 1986; Everest 1973). The length of the incubation period for steelhead eggs is dependent on water temperature, dissolved oxygen concentration, and substrate composition. In late spring and following yolk sac absorption, alevins emerge from the gravel as fry and begin actively feeding in shallow water along perennial stream banks (Nickelson et al. 1992).

Summer rearing takes place primarily in higher velocity areas in pools, although young-of-the-year are also abundant in glides and riffles. Winter rearing occurs more uniformly at lower densities across a wide range of fast and slow habitat types. Productive steelhead habitat is characterized by complexity, primarily in the form of large and small woody debris. Some older juveniles move downstream to rear in larger tributaries and mainstem rivers (Nickelson et al. 1992). Juveniles feed on a wide variety of aquatic and terrestrial insects (Chapman and Bjornn

1969), and older juveniles sometimes prey upon emerging fry. Juveniles live in freshwater from one to four years (usually two years in California), then smolt and migrate to the sea from February through April, although some steelhead smolts may outmigrate during the fall and early winter months (Barnhart 1986). California steelhead typically reside in marine waters for one to two years prior to returning to their natal stream to spawn as three- or four-year old's (Busby et al. 1996).

2. Population Trends - Central Valley steelhead

Central Valley steelhead once ranged throughout most of the tributaries and headwaters of the Sacramento and San Joaquin basins prior to dam construction, water development, and watershed perturbations of the 19th and 20th centuries (McEwan and Jackson 1996; CALFED 2000). In the early 1960s, the *California Fish and Wildlife Plan* estimated a total run size of about 40,000 adults for the entire Central Valley including San Francisco Bay (DFG 1965). The annual run size for this ESU in 1991-92 was probably less than 10,000 fish based on dam counts, hatchery returns and past spawning surveys (McEwan and Jackson 1996). A more reliable indicator of the magnitude of the decline is the trend in the Red Bluff Diversion Dam (RBDD) counts on the upper Sacramento River. Steelhead counts at RBDD have declined from an annual average of 11,187 adults in the late 1960's to 2,202 adults in the 1990's (McEwan 2001). A review of all known dam counts, adult counts, and redd surveys indicates the annual run size for the Central Valley population has decreased to less than 4,000 fish in 2002 (Appendix 1).

At present, all CV steelhead are considered winter-run (McEwan and Jackson 1996), although there are indications that summer steelhead were present in the Sacramento River system prior to the commencement of large-scale dam construction in the 1940s (IEP Steelhead Project Work Team 1999). McEwan and Jackson (1996) reported wild steelhead stocks appear to be mostly confined to upper Sacramento River tributaries such as Antelope, Deer, and Mill creeks and the Yuba River. However, naturally spawning populations are also known to occur in Butte Creek, and the upper Sacramento mainstem, Feather, American, Mokelumne, Calaveras and Stanislaus rivers (CALFED 2000, McEwan 2001).

Steelhead adults migrate upstream in the Sacramento River during the period between December and March to spawn and are likely to enter into the Feather River during the same period. Most steelhead that return to the Feather River are of hatchery origin. Very limited information exists regarding the location, timing and magnitude of wild steelhead spawning within the river. Observations to date suggest the low flow channel is the primary reach for steelhead spawning (DWR and Reclamation 2000). The 14-mile section between the Thermalito Afterbay Outlet and the mouth of Honcut Creek (referred to as the high flow section) supports considerable numbers of fall-run Chinook salmon spawners and could support some steelhead spawning. It is possible that other naturally spawning populations exist in CV streams, but are undetected due to lack of monitoring and research programs. The recent implementation of new monitoring efforts has found steelhead in streams previously thought not to contain a population, such as Auburn

Ravine, Dry Creek, Calaveras River and the Stanislaus River (IEP Steelhead Project Work Team 1999).

Recent analysis of strontium: alcium ratios in otoliths extracted from rainbow trout in the Calaveras River indicate that at least some CV rainbow trout populations are polymorphic (McEwan 2001). The progeny of one life-history form can assume a life-history strategy different from that of their parents. Therefore, in some cases a polymorphic population structure may be necessary in order to persist in the highly variable environments of the Central Valley. NOAA Fisheries, although recognizing the importance of these resident trout populations in maintaining anadromous forms, did not list as threatened resident rainbow trout that occur in the same streams as steelhead.

Additional historical and recently published steelhead abundance are summarized in the NOAA Fisheries West Coast steelhead status review (Busby et al. 1996) and CV Steelhead (McEwan 2001). McEwan (2001), published in DFG-Fish Bulletin 179, discusses the historical and current status of CV steelhead including factors affecting their decline, with an assessment of current monitoring and management effectiveness. The factors contributing to the decline of CV steelhead are described in the Environmental Baseline section below.

IV. ENVIRONMENTAL BASELINE

A. Geographic Scope and Action Area

The environmental baseline is an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species. The environmental baseline includes the past and present impacts of all federal, state, or private actions and other human activities in the action area (50 CFR 402.02). For the purposes of this Opinion, the action area includes the following: Shasta Dam and the reaches of the Sacramento River downstream to San Francisco Bay that may be affected by the operation of Reclamation facilities; Whiskeytown Dam and the reaches of Clear Creek downstream to the confluence with the Sacramento River that may be affected by the operation of Reclamation facilities; Oroville Dam and the reaches of the Feather River downstream to the San Francisco Bay that may be affected by the operation of DWR facilities; Folsom Dam and the reaches of the American River downstream to San Francisco Bay that may be affected by the operation of Reclamation facilities; New Melones Dam and the reaches of the Stanislaus River downstream to the Delta that may be affected by the operation of Reclamation facilities; and the entire Delta that may be affected by the operation of CVP and SWP facilities.

B. Central Valley Environmental Baseline

Profound alterations to the riverine habitat of the Central Valley began with the discovery of gold in the 1850s. Dam construction, water diversion, and hydraulic mining soon followed, launching the Central Valley into an era of water manipulation and coincident habitat degradation. A number of documents have addressed the history of human activities, present environmental conditions, and factors contributing to the decline of salmon and steelhead species in the Central Valley. For example, NOAA Fisheries prepared range-wide status reviews for west coast Chinook salmon (Myers et al. 1998) and steelhead (Busby et al. 1996). Information is also available in Federal Register notices announcing ESA listing proposals and determinations for some of these species and their critical habitat (June 16, 1993, 58 FR 33212; January 4, 1994, 59 FR 440; March 19, 1998, 63 FR 13347; September 16, 1999, 64 FR 50394; February 16, 2000, 65 FR 7764). The Final Programmatic Environmental Impact Statement/Report (FPEIS/R) for the CALFED Bay-Delta Program dated July 2000, and the FPEIS for the CVPIA October 1999, provide an excellent summary of historical and recent environmental conditions for salmon and steelhead in the Central Valley. Also, more recent information on the status of CV steelhead is discussed in DFG, Fish Bulletin 179, Volume 1 (McEwan 2001). The following general description of the environmental baseline for CV spring-run Chinook salmon, and CV steelhead is based on a summarization of these documents.

In general, the human activities that have affected listed CV anadromous salmonids and their habitats consist of: (1) dam construction that blocks previously accessible habitat; (2) water development and management activities that affect water quantity, timing, and quality; (3) land use activities such as agriculture, flood control, urban development, mining, and logging that degrade aquatic and riparian habitat; (4) hatchery operation and practices; (5) harvest activities; and (6) ecosystem restoration actions.

1. Habitat Blockage

Hydropower, flood control, and water supply dams of the CVP, SWP, and other municipal and private entities have permanently blocked or hindered salmonid access to historical spawning and rearing grounds. Clark (1929) estimated that originally there were 6,000 miles of salmon habitat in the Central Valley system and that 80 percent of this habitat had been lost by 1928. Yoshiyama et al. (1996) calculated that roughly 2,000 miles of salmon habitat was actually available before dam construction and mining, and concluded that 82 percent is not accessible today. Clark (1929) did not give details about his calculation. Whether Clark's or Yoshiyama's calculation is used, only remnants of their former range remain accessible today in the Central Valley (DFG 1998, McEwan 2001).

In general, large dams on every major tributary to the Sacramento River, San Joaquin River, and Delta block salmon and steelhead access to the upper portions of the respective watersheds. On the Sacramento River, Keswick Dam blocks passage to historic spawning and rearing habitat in the upper Sacramento, McCloud and Pit rivers. On the Feather River, Oroville Dam and associated facilities block passage to the upper Feather River watershed. Nimbus Dam blocks access to most of the American River Basin. On the San Joaquin River, water development projects in the 19th century eliminated fall-run Chinook salmon that spawned in the mainstem of the river. Friant Dam construction in mid-1940s has been associated with the elimination of spring-run Chinook salmon in the San Joaquin River upstream of the Merced River. On the

Stanislaus River, construction of New Melones Dam and Goodwin Dam blocked both spring-run and fall-run Chinook salmon (DFG 2001).

As a result of these dams, spring-run Chinook salmon and steelhead populations on these rivers have been confined to lower elevation mainstem reaches that were historically only used for migration. Population abundances have declined in these streams due to decreased quantity and quality of spawning and rearing habitat. Higher temperatures at these lower elevations during late-summer and fall are a major stressor to adults and juvenile salmonids.

Large reservoirs such as Shasta an Oroville with stratified water columns have allowed for management of water temperatures below dams. These releases are used to create beneficial habitat conditions for winter-run and fall-run Chinook salmon, but neglect the needs of steelhead and spring-run Chinook salmon. In some rivers (such as the upper Sacramento River) stable cold water releases in the summer below dams have created an exceptional resident rainbow trout fishery which may displace the former steelhead population (Cramer 2000). Other reservoirs, such as Folsom, do not have adequate minimum pool storage to provide releases for steelhead rearing through the summer and fall periods. However, on September 7, 1999, and again on September 10, 1999, Reclamation increased flows in Clear Creek in 50 cfs increments to improve temperature conditions for spawning and incubating spring-run Chinook salmon. Water temperatures generally dropped by one degree in lower Clear Creek within 48 hours in response to each flow increase. Reclamation's temperature control efforts in September 1999, avoided significant losses of spring-run Chinook salmon eggs and fry below McCormick-Saeltzer Dam, showing that flexibility in real time operations and use of work groups, such as B2IT, can reduce temperature related impacts.

2. Water Development Activities

The diversion and storage of natural flows by dams and diversion structures on Central Valley waterways have depleted stream flows and altered the natural cycles by which juvenile and adult salmonids base their migrations. Depleted flows have contributed to higher temperatures, lower dissolved oxygen levels, and decreased recruitment of gravel and large woody debris. In addition, the altered flow regime below several Central Valley dams has impaired the regeneration of riparian vegetation. Historical seasonal flow patterns included high flood flows in the winter and spring with declining flows throughout the summer and early fall. As flows declined during the summer, the seeds from willows and cottonwood trees, deposited on the recently created sand bars, would germinate, sprout, and grow to maturity. The roots of these plants would follow the slowly receding water table, allowing the plants to become firmly established before the next rainy season. With the completion of upstream reservoir storage projects throughout the Central Valley, the seasonal distribution of flows differed substantially from historical patterns. Rapid flow fluctuations become the norm to balance the diverse requirements placed on the projects, to meet their obligations for water supply, power generation, and water quality standards. The magnitude and duration of peak flows during the winter and spring are reduced by water impoundment in upstream reservoirs. Instream flows during the summer and early fall months have increased over historic levels for deliveries of municipal and agricultural water supplies. Overall, water management now reduces natural variability by creating more uniform flows year-round, which diminish natural channel forming, riparian vegetation, and food web functions. These stable flow patterns have created armored gravels, reduced bedload movement (Ayers 2001) and reduced channel width that decrease the available spawning and rearing habitat in the reaches below dams.

Water diversions for irrigated agriculture, municipal and industrial use, and managed wetlands are found throughout the Central Valley. Hundreds of small and medium size water diversions exist along the Sacramento River, San Joaquin River and their tributaries. Depending on the size, location, and season of operation, these unscreened intakes entrain many life stages of aquatic species, including juvenile salmonids. More than 2,000 unscreened diversions in the Delta entrain resident and anadromous fishes. The cumulative effect of all these diversions combined directly reduce the number of juvenile salmonids entering the San Francisco Bay, as well as reducing the amount of food available.

3. Land Use Activities

About 150 years ago, the Sacramento River was bordered by up to 500,000 acres of riparian forest, with bands of vegetation literally spreading four to five miles (Resources Agency 1989). By 1979, riparian habitat along the Sacramento River diminished to 11,000-12,000 acres or about 2 percent of historic levels (McGill 1979). More recently, about 16,000 acres of remaining riparian vegetation has been reported (McGill 1987). The degradation and fragmentation of riparian habitat has resulted mainly from flood control and bank protection projects, together with the conversion of riparian land to agriculture (Jones and Stokes Associates 1993).

Increased sedimentation resulting from agricultural and urban practices within the Central Valley is a primary cause of salmonid habitat degradation. Sedimentation can adversely affect salmonids during all freshwater life stages by clogging, or abrading gill surfaces; adhering to eggs; inducing behavioral modifications; burying eggs or alevins; scouring and filling pools and riffles; reducing primary productivity and photosynthetic activity; and affecting intergravel permeability and dissolved oxygen levels. Embedded substrates can reduce the production of juvenile salmonids and hinder the ability of some over-wintering juveniles to hide in the gravels during high flow events.

Land use activities associated with road construction, urban development, logging, mining, agriculture, and recreation have significantly altered fish habitat quantity and quality through alteration of streambank and channel morphology; alteration of ambient stream water temperatures; degradation of water quality; elimination of spawning and rearing habitat; fragmentation of available habitats; elimination of downstream recruitment of gravel and large woody debris; and removal of riparian vegetation resulting in increased streambank erosion. Agricultural practices have eliminated large trees and logs and other woody debris that would have been otherwise recruited to the stream channel. Large woody debris influences stream morphology by affecting pool formation, channel pattern and position, and channel geometry.

Historically in the Delta, tidal marshes provided a highly productive estuarine environment for juvenile anadromous salmonids. During the course of their downstream migration, juvenile spring-run Chinook salmon and steelhead utilize the Delta's estuarine habitat for seasonal rearing, and as a migration corridor to the sea. Since the 1850s, reclamation of Delta islands for agricultural purposes caused the cumulative loss of 94 percent of the Delta's tidal marshes (Monroe et al. 1992).

In addition to the degradation and loss of estuarine habitat, outmigrant juvenile salmonids in the Delta have been subjected to adverse environmental conditions created by water export operations at the CVP/SWP. Specifically, juvenile salmonid survival has been reduced from (1) water diversion from the mainstem Sacramento River into the Central Delta via the manmade Delta Cross Channel; (2) upstream or reverse flows of water in the lower San Joaquin River and southern Delta waterways; (3) entrainment at the CVP/SWP export facilities and associated problems at Clifton Court Forebay, and (4) increased exposure to introduced non-native predators such as striped bass, large-mouth bass, and American Shad. Juvenile salmonids are exposed to increased water temperatures in the Delta during the late spring and summer due to the loss of riparian shading, and by thermal inputs from municipal, industrial, and agricultural discharges. Studies by DWR on water quality in the Delta over the last 30 years show a steady decline in the food sources available for juvenile salmonids and an increase in the clarity of the water (Zach Hymanson, IEP Worshop 2002). These conditions have increased mortality and decreased survival of juvenile spring-run Chinook salmon and steelhead.

4. Hatchery Operation and Practices

Five hatcheries currently produce Chinook salmon in the Central Valley and four of these also produce steelhead. Releasing large numbers of hatchery fish can pose a threat to wild salmon and steelhead stocks through genetic impacts, competition for food and other resources between hatchery and wild fish, predation by hatchery fish on wild fish, masking declines in natural stocks and increased fishing pressure on wild stocks as a result of hatchery production (Waples 1991). The genetic impacts of artificial propagation programs in the Central Valley are primarily caused by straying of hatchery fish and the subsequent hybridization of hatchery and wild fish. In the Central Valley, practices such as trucking smolts to distant sites for release and the transferring of eggs between hatcheries contribute to elevated straying levels (NOAA Fisheries/DFG 2001). The loss of genetic variability can lead to decreased survival of naturally spawning fish.

Snorkel surveys conducted by FWS and DFG during the summer of 1999 identified 35+ adult Chinook salmon in Clear Creek. Only one of these fish was observed above McCormick-Saeltzer Dam. Two of the Chinook observed in 1999 were from FRH, which indicates straying may be of concern. Since there is not a fishery management plan or ESA recovery plan in place, this area has been left alone to naturally re-colonize. Due to the greater chance of FRH or Coleman Hatchery fish straying into Clear Creek than wild fish, hybridization of spring-run and fall-run Chinook salmon may occur unless measures are taken to separate the runs. After removal of McCormick-Saeltzer Dam in November 2000, snorkel surveys identified 17 adult Chinook salmon above the former dam site; of these 9 were killed before spawning due to poaching or predators (pers. comm. Matt Brown 2001).

The management of hatcheries, such as Nimbus and Feather River, can directly impact spring-run Chinook salmon and steelhead populations by overproducing the natural capacity of the limited habitat available below dams. In the case of the FRH, significant redd superimposition occurs due to the inability of the hatchery to physically separate spring-run and fall-run Chinook salmon adults, which has lead to hybridization between the runs. At Nimbus Hatchery, operating Folsom Dam to meet temperature requirements for fall-run Chinook salmon has limited the amount of water available for steelhead spawning and rearing the rest of the year.

The increase in Central Valley hatchery production has completely reversed the composition of the steelhead population, from 88 percent naturally produced in the 1950s (McEwan 2001) to 75 percent hatchery produced currently (DFG 2001 unpublished). This change has reduced the fitness of the population, increased the use of out-of-basin stocks, and increased straying (NOAA Fisheries/DFG 2001). Thus, the ability of natural populations to successfully reproduce is diminished.

5. Harvest

Extensive ocean recreational and commercial troll Fisheries for Chinook salmon exist along the Central California coast, and an inland recreational fishery exists in the Central Valley for Chinook salmon and steelhead. Ocean harvest of Central Valley Chinook salmon is estimated using an annual abundance index, called the Central Valley Index (CVI). The CVI is the ratio of ocean harvest caught south of Point Arena (85 percent which are of Central Valley origin) to ocean harvest plus adult spawning escapement in the Central Valley. Therefore, the CVI tends to decrease with lower ocean harvest and higher spawning escapement.

Since 1970, the CVI for winter-run Chinook salmon has generally ranged between 0.50 and 0.80. In 1990, when additional harvest restrictions to protect winter-run Chinook salmon were first imposed by NOAA Fisheries and the Pacific Fisheries Management Council (PFMC), the CVI was near the highest level at 0.79. Through the early 1990s, the CVI was 0.71 in 1991, 0.71 in 1992, 0.72 in 1993, 0.74 in 1994, 0.78 in 1995 and 0.64 in 1996. In 1996 and 1997, NOAA Fisheries issued biological opinions which concluded that incidental ocean harvest of winter-run Chinook salmon represented a significant source of mortality to the endangered population, even though ocean harvest was not a key factor leading to the decline of the population. As a result of these biological opinions, measures were developed and implemented by the PFMC, NOAA Fisheries, and DFG to reduce ocean harvest impacts by approximately 50 percent.

There are limited data on spring-run Chinook salmon ocean harvest rates. An analysis using CWT spring-run from the FRH estimate harvest rates were 18 percent to 22 percent for age-3 fish, 57 percent to 85 percent for age-4 fish, and 97 percent to 100 percent for age-5 fish (DFG 1998).

Historically, in California, almost half of the river sportfishing effort was in the Sacramento-San Joaquin River system, particularly upstream from the city of Sacramento (Emmett et al. 1991). Since 1987, the Fish and Game Commission has adopted increasingly stringent regulations to reduce and virtually eliminate the in-river sport fishery for winter-run Chinook salmon. Present regulations include a year-round closure to salmon fishing between Keswick Dam and the Deschutes Road Bridge and a rolling closure to salmon fishing on the Sacramento River between the Deschutes Road Bridge and the Carquinez Bridge. The rolling closure spans the majority of months adult winter-run and spring-run Chinook salmon are ascending the Sacramento River to their spawning grounds. After July 1, the salmon fishing season opens up again, but by this time most spring-run fish have migrated above Deschutes Road Bridge and are protected by the closure. Steelhead, on the other hand, are not protected by these regulations and in the upper Sacramento River anglers are still allowed to keep one wild trout per day (no size restriction) above Deschutes Road Bridge during the winter months when spawning is occurring. Below the Deshutes Road Bridge to five miles above Red Bluff anglers are allowed to keep one wild trout all year.

To address potential incidental take that occurs in the recreational trout fishery, in 1992, the California Fish and Game Commission adopted gear restrictions (all hooks must be barbless and a maximum 2.25 inches in length) to minimize hooking injury and mortality caused by trout anglers in the Upper Sacramento River. That same year, the Commission also adopted regulations, which prohibited any salmon from being removed from the water to further reduce the potential for injury and mortality. While this may benefit spring-run Chinook salmon it does nothing for steelhead. However, since 1998, all hatchery steelhead have been marked with an adipose fin clip allowing anglers to tell the difference between hatchery and wild steelhead. Current regulations restrict anglers from keeping unmarked steelhead in Central Valley streams, except in the upper Sacramento River as mentioned previously. Overall, this regulation has greatly increased protection of naturally produced adult steelhead.

Specific regulations for the protection of spring-run Chinook salmon in Mill, Deer, Big Chico, and Butte creeks were added to the existing DFG regulations in 1994. Existing regulations, including those developed for winter-run fish provide some level of protection for spring-run fish (DFG 1998).

There is little information on steelhead harvest rates in California. Hallock et al. (1961) estimated that harvest rates for Sacramento River steelhead from the 1953-54 through 1958-59 seasons ranges from 25.1 percent to 45.6 percent assuming a 20 percent non return rate of tags. Staley (1976) estimated the harvest rate in the American River during the 1971-72 and 1973-74 seasons to be 27 percent. The average annual harvest rate on adult steelhead above Red Bluff Diversion Dam for the three year period 1992-94 was16 percent (McEwan and Jackson 1996).

DFG conducted angler surveys in the Central Valley from 1998 through 2000 for the Sacramento, American, Feather, Yuba, San Joaquin, Mokelumne, and Stanislaus rivers. Most of the steelhead angler effort was focused on the American and Feather rivers. Peak angling effort occurred in January on the American River, but much earlier in October and November on the Feather River. The surveys show an increasing trend in angler harvest and effort from 210 in 1998 to 1,014 steelhead in 2000 (DFG 1999-2001). The steelhead run in the Stanislaus River is believed to be very small. A few steelhead greater than 24 inches are reported caught by anglers and seen in adult surveys, however a review of DFG angler surveys from 1998 through 2001 showed none have been caught.

6. Ecosystem Restoration

Preliminary, significant steps towards the largest ecological restoration project yet undertaken in the United States have occurred during the past four years and continue to proceed in California's Central Valley. The CALFED Program, in coordination with other Central Valley efforts including the CVPIA, has implemented numerous habitat restoration actions that benefit CV steelhead, CV spring-run Chinook salmon, and their critical habitat. These restoration actions include the installation of fish screens, modification of barriers to improve fish passage, and habitat acquisition and restoration. The majority of these recent restoration actions address key factors for decline of these ESUs and emphasis has been placed in tributary drainages with high potential for steelhead and spring-run Chinook salmon production. Additional ongoing actions include new efforts to enhance Fisheries monitoring and conservation actions to address artificial propagation. In the Delta, approximately 1,500 acres of land have been purchased for restoration activities since 1996. Restoration of these Delta areas primarily involves flooding lands previously used for agriculture, thereby creating additional wetland areas and rearing habitat for juvenile salmonids. These actions in combination should benefit listed salmonids in the action area.

A beneficial action unrelated to the CALFED Program and the CVPIA includes the Environmental Protection Agency's (EPA's) Iron Mountain Mine remediation. A state-of-the-art lime neutralization plant is removing significant concentrations of toxic metals in acidic mine drainage from the Spring Creek Watershed. Contaminant loading into the upper Sacramento River from Iron Mountain Mine has shown measurable reductions since the early 1990s. Decreasing the heavy metal contaminants that enter the Sacramento River should increase the likelihood of survival for eggs and juveniles. However, during periods of heavy rainfall above the Iron Mountain Mine, Reclamation substantially increases Sacramento River flows in order to dilute heavy metal contaminants being spilled from Spring Creek debris dam. This rapid change in flows can cause juvenile salmonids to become stranded or isolated in side channels below Keswick Dam.

SWP Delta Pumping Plant Fish Protection Agreement (4-Pumps Agreement)

Pursuant to the SWP's 4-Pumps Agreement with DFG, four projects which benefit CV spring-run Chinook salmon and CV steelhead have been implemented or partially funded by DWR[1]. Although the 4-Pumps Agreement was intended to address and offset only direct losses of Chinook salmon and other species caused by the SWP Delta Pumping Plant, certain projects implemented by or partially funded through the 4-Pumps Agreement create benefits that mitigate not only direct, but also indirect, adverse effects to CV spring-run Chinook salmon and CV steelhead that are caused by SWP operations from March 2002, through March 2004. These projects are (1) increased overtime for DFG wardens, (2) funds to cover over-budget costs of the Durham Mutual and Parrot Phelan Screen and Ladders project on Butte Creek, (3) Mill and Deer Creek Water Exchange Program, and (4) San Joaquin River tributary spawning habitat enhancement projects. Increased warden overtime provides protection from poaching for spring-run adults holding in upstream tributary pools.

The 4-Pumps Agreement funds two enhanced enforcement programs throughout the range of CV spring-run Chinook salmon and CV steelhead. Through the provision of overtime wages for DFG wardens, the Spring-run Salmon Increased Protection Project allows for increased focus on poaching of adult Chinook salmon from Sacramento River tributaries. Through the Delta-Bay Enhanced Enforcement Program (DBEEP), a team of ten wardens focus their enforcement efforts on salmon, steelhead, and other species of concern. These two enhanced enforcement programs, in combination with additional concern and attention from local landowners and watershed groups on the Sacramento River tributaries which support spring-run Chinook salmon summer holding habitat, have been shown to reduce the amount of poaching in these upstream areas.

The provisions of funds to cover over-budget costs for the Durham Mutual/Parrot Phelan Screen and Ladders project expedited completion of the construction phase of this project which was completed during 1996. The project continues to benefit salmon and steelhead by facilitating upstream passage of adult spawners and downstream passage of juveniles.

The Mill and Deer Creek Water Exchange projects are designed to provide new wells that enable diverters to bank groundwater in place of stream flow, thus leaving water in the stream during critical migration periods. On Mill Creek several agreements between Los Malawians Mutual Water Company (LMMWC), Orange Cove Irrigation District (OCID), DFG, and DWR allows DWR to pump groundwater from two wells into the LMMWC canals to pay back LMMWC

[1]Based on supplemental information regarding DWR's program to mitigate the impacts of SWP operations in the Delta, including estimates of direct and indirect losses of spring-run Chinook salmon smolts in the Delta from 1996 through 2000 and predicted annual spring-run Chinook benefits in smolt equivalents, DWR asserts that these projects provide quantifiable benefits to spring-run Chinook salmon and have more than replaced the spring-run losses resulting from the SWP's Delta operations. Although DFG disagrees with specific assumptions and calculations used by DWR in its analysis, DFG concurs based on its own analysis that for the period covered by this biological opinion (March 2001-2004), these projects that are currently implemented provide benefits that likely mitigate both direct and indirect effects to spring-run Chinook salmon by SWP Delta operations.

water rights for surface water released downstream for fish. Although the Mill Creek Water Exchange project was initiated in 1990 and the agreement provides for a well capacity of 25 cfs, only 12 cfs has been developed to date (Orange Cove Irrigation District 1999). In addition, it has been determined that a base flow of greater than 25 cfs is needed during the April through June period for upstream passage of adult spring-run Chinook salmon in Mill Creek (Reclamation and Orange Cove Irrigation District 1999). In some years, water diversions from the creek are curtailed by amounts sufficient to provide for passage of upstream migrating adult spring-run Chinook salmon and downstream migrating juvenile steelhead and spring-run Chinook salmon. However, the current arrangement does not ensure adequate flow conditions will be maintained in all years. On Deer Creek a pilot project using two of the ten proposed pumps is planned, but was not operational as of March 2002.

C. Summary of Environmental Baseline

The single greatest factor affecting the CV spring-run Chinook salmon and CV steelhead within the action area is the loss of spawning and rearing habitat due to the construction of impassable dams. As a result of these dams, CV spring-run Chinook salmon and CV steelhead are confined to lower elevation mainstem reaches that were historically only used for migration. Population abundances have declined in these streams due to decreased quantity and quality of spawning and rearing habitat. High water temperatures at these lower elevations during late-summer/fall are a major stressor to adult and juvenile life stages. Currently, the limiting factors that affect the likelihood of survival and recovery for these species are high temperatures, low flows, reduced spawning and rearing habitat, passage delays at RBDD and flow fluctuations.

Recent studies indicate large numbers of incubating and rearing salmonids can be lost due to isolation and stranding (DWR 2002; Snider 2002). This is of particular significance given that spring-run Chinook salmon and steelhead spawning habitat has been reduced to only a few miles below CVP and SWP dams. This is habitat that was never historically used for spawning, but must now be manipulated and controlled by project operations to provide the only habitat that can perpetuate the species. For spring-run Chinook salmon there are other non-project tributaries in the Central Valley that provide critical spawning habitat, but for steelhead 95 percent of the population (based on angler harvest) resides in the American, Feather, and Sacramento rivers. It is therefore of utmost importance that flow fluctuations, including those required for flood control, be minimized through timing, modified flood control curves or ramp down rates for all stages of steelhead and spring-run life history.

Through the CALFED Ecosystem Restoration Program (ERP), other state programs (Prop. 13), and local cost sharing (irrigation districts) funding has been provided to facilitate the removal of small dams and diversions which will increase the spawning and rearing habitat available in the action area. Some examples of these projects are the removal of McCormick-Saeltzer Dam on Clear Creek in 2000, the removal of Clough Dam on Mill Creek in 2002, and new fish ladders and screens on ACID in 2001(upper Sacramento River). In addition, numerous other actions are making strides at improving the Central Valley habitat for salmonids, such as; the CVPIA-AFRP salmon doubling goals, the use of EWA and (b)(2) water accounts, the COE's flood-plain inundation projects, EPA's action to clean up heavy metals from Iron Mountain Mine, and DWR's operation of the temporary barriers in the Delta.

Past actions of the CVP and SWP have caused a reduction in the reproductive success, numbers, and distribution of both CV spring-run Chinook salmon and CV steelhead. However, implementation of the CVPIA, CALFED program, and regulatory criteria in NOAA Fisheries and FWS biological opinions has reduced the likelihood that any one year class could be reduced to population levels that may not recover in the action area.

V. EFFECTS OF THE ACTION

For purposes of this Opinion, the 50%, and 90% exceedence forecasts are used for 2002 and the 75% exceedence forecast is used for 2003 through 2004 to assess the impacts to CV spring-run Chinook salmon and CV steelhead. WY 2002-2004 SWP/CVP Operations Plan and forecasts include the implementation of EWA and CVPIA (b)(2). Also, the water temperatures predicted for 2002-2004 are based on March 2002 through March 2004 flow forecasts. Stream flow and water temperature forecasts are based on monthly time step models, except for American River temperatures, which are based on weekly averages; therefore, daily flow release and daily temperatures can fluctuate from the monthly values. It is known that rapid flow and temperature fluctuations can have a negative effect on juvenile salmonids. Recent studies on the American River by DFG have shown that repeated flow changes have the potential to strand and isolate juvenile salmonids as well as dewater redds (DFG 2001). However, it is assumed that the expected flow fluctuations around the monthly average will not decrease the likelihood of survival and recovery, due to the flexibility in real time operations and adaptive management using various work groups associated with CVP/SWP operations, such as: the Sacramento River Temperature Control Team, AROG, B2IT, DAT, WOMT and CALFED-OPS. The recommendations of these groups are used to manage real-time operations to reduce or avoid impacts to

Water temperatures on the Sacramento River are modeled to stay within a 3°F daily fluctuation through the use of the TCD on Shasta Dam and inflows from Spring Creek diversion. Water temperatures on the American River fluctuate by as much as 5°F daily depending on air temperatures and time of year. Average monthly air temperatures are used in the models; therefore, higher than normal air temperatures can cause daily water temperatures to increase above the expected range. Reclamation is required to maintain flows in a stable pattern according to the AFRP stability criteria, and coordinated agreements with DFG. However, there are instances, especially on the American River, where rapid flow changes are required to meet water quality control standards in the Delta. In order to account for short-term variability in flows and temperatures, temperatures lower than those indicated in the model are targeted in order to avoid exceeding the required downstream compliance points. Flows are usually held within a specific range that minimizes disturbances to critical life stages (i.e., spawning, emergence, rearing) after consulting with the appropriate work group. Due to the uncertainty in operation of the TCD, a more conservative approach is taken in real-time operations than is fully represented by the model results. These conditions will be discussed in detail under each river section.

A. Clear Creek

1. Adult Migration, Spawning, and Incubation

From March 2002 through March 2004, Reclamation proposes to release 150 cfs from Whiskeytown Reservoir to Clear Creek except for November and December when flows would be increased to 200 cfs for salmon spawning. However, due to recent court rulings[2] on the use of CVPIA (b)(2) water, summer-time releases may be reduced to 50 cfs in the 90% forecast. Currently, Reclamation is operating to the forecasted flow pattern even though the FWS has stated there is no (b)(2) water available for beneficial upstream fish actions.

This release schedule is consistent with the AFRP flow targets for Clear Creek, unless releases drop below 150 cfs. Currently, Clear Creek is at 150 cfs and forecasted to stay at that flow until September. The AFRP flow targets are within the average range of total annual unimpaired flows to the Clear Creek watershed. Predicted monthly average temperatures at the mouth of Clear Creek under all exceedence forecasts would range from 39°F to 58°F during the fall/winter period and 52°F to 59°F during the summer (June-September) period. Temperatures upstream of the mouth in Clear Creek are predicted to be slightly cooler.

CV steelhead migrate upstream from the Sacramento River into Clear Creek during December through March to spawn. Ten miles of spawning and rearing habitat for CV steelhead and CV spring-run Chinook salmon are now available to the base of Whiskeytown Dam due to the removal of McCormick Saeltzer Dam. Based on observations in the Sacramento River, steelhead typically spawn from December through April, with peak spawning occurring from January through March (Hallock et al. 1961, as cited in McEwan and Jackson 1996). Flows in Clear Creek ranging from 150 to 200 cfs are expected to provide adequate depths and velocities for upstream passage of steelhead adults and spring-run Chinook salmon adults based on snorkel survey results from fall-run Chinook salmon counts. In 2001, FWS snorkel surveys observed 45 steelhead redds below the base of Whiskeytown Dam (pers. comm. Matt Brown 2001). Predicted water temperatures are within the range of preferred spawning temperatures for both species. In addition, tributary inflows downstream of Whiskeytown Dam may add additional attraction during the upstream migration period.

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[2]Recent Federal District Court Rulings by Judge Wander:(1) October 19,2001 Decision removed 450 TAF cap on WQCP costs, and considered all water costs post CVPI-enactment that are ESA requirements part of the 800 TAF (such as releases for winter-run Chinook temperature control), (2) February 5, 2002 Decision eliminated the use of offset and reset in the B(2) accounting (limited ability to use water from upstream reservoir releases).

Egg incubation to emergence of steelhead fry can take as little as eight to ten weeks to occur after fertilization depending on redd depth, gravel size, siltation, and temperature (Leitritz and Lewis 1980, Shapovalov and Taft 1954, as cited in McEwan and Jackson 1996). Accordingly, emergence may occur anytime from approximately mid-February through May. Predicted monthly average temperatures at the mouth of Clear Creek are within the range of preferred incubating and emergence temperatures (48°F to 52°F) from December through May. Cooler temperatures during these months are likely to slow the development of incubating eggs and pre-emergent fry resulting in a longer incubation period. For spring-run Chinook salmon, spawning primarily occurred during September and emergence of fry from redds is predicted for December and January based on expected temperatures. Predicted monthly average temperatures are within the range of preferred temperatures (53°F to 58°F) for spring-run Chinook salmon eggs and fry, except during October (59°F) in the 75% exceedence forecast. The October water temperature effect is not likely to adversely affect spring-run Chinook salmon eggs, since it is only one degree above the upper limit of the preferred range and slightly cooler temperatures are predicted downstream to the mouth.

During December through March, large flow releases from Whiskeytown Dam to Clear Creek may be required for short durations by Reclamation for flood control and *safety of dams* criteria. In addition, large flow releases (1,200 cfs/day) are being planned to remove sediment and reform the channel above McCormick-Saeltzer Dam. Short duration, high flow events can scour steelhead redds and result in the injury and mortality of steelhead eggs and sac-fry. These high flows may effect spring-run Chinook salmon during December and January as well.

2. Fry, Juveniles, and Smolts

For fry and juvenile spring-run Chinook salmon and steelhead, water temperatures between 50°F and 60°F and 45°F to 60°F, respectively, are preferred for growth and development. Predicted monthly average temperatures in Clear Creek from January through December are either slightly below or within the preferred temperature range for steelhead and are below preferred temperatures for spring-run Chinook salmon. Predicted monthly flows are expected to provide adequate juvenile rearing habitat for both species based on a more stable flow pattern than the pre-dam condition, therefore are considered beneficial.

3. Predictive Temperature Model

The predictive temperature model for Clear Creek uses average ambient air temperatures as part of the input data set to produce monthly water temperatures. In the event that ambient air temperatures exceed the average conditions, warming of Whiskeytown releases during passage downstream could be underestimated. A temperature study conducted on Clear Creek during the summer of 1998 (FWS unpublished data) found that release temperatures at Whiskeytown Dam used in the temperature modeling forecasts were almost five degrees cooler than the actual release temperatures. Consequently, the temperature modeling provided in the December 2001 BA may significantly underestimate temperatures within Clear Creek in the summer months. A five degree increase in temperatures is unlikely to cause a significant effect on fish or habitat except in October when adult spring-run Chinook salmon are present. However, it is expected that these adults can move to cooler areas below Whiskeytown Dam and wait till temperatures drop to spawn (FWS, unpublished snorkel survey data).

Reclamation has not proposed any ramping criteria for Whiskeytown Dam releases to Clear Creek. Flows in Clear Creek may increase or decrease rapidly in response to Whiskeytown Reservoir flood control or *safety of dams* criteria. Isolation of juvenile steelhead and spring-run Chinook salmon may occur in areas that are not connected to the creek except during periods of high flows. Juvenile salmon have been observed in pools and side channels adjacent to Clear Creek when flows were decreased from 200 cfs in May to 50 cfs in June (Matt Brown, FWS, personal communication 1999). If no additional high flow events follow within a short period of time, these fish may be lost to predation, lethal water temperature conditions, or desiccation of habitat, which would reduce the numbers of steelhead and/or spring-run Chinook salmon.

Based on emigration patterns of steelhead in the upper Sacramento River, steelhead juveniles and smolts may emigrate downstream and out of Clear Creek from October through early July (McEwan and Jackson 1996; SARI 1997 *op cit* DWR and Reclamation 2000). Predicted flows in Clear Creek are expected to provide suitable depths and velocities for juvenile steelhead rearing and emigration from October through May, as this is consistent with AFRP minimum instream flow requirements. There is a lack of information on optimal flows for juvenile steelhead on Clear Creek and it is anticipated that the FMP will address this need. Predicted water temperatures in Clear Creek are expected to be within, or below, preferred temperatures for juvenile steelhead rearing and emigration between March 2002 and March 2004. Current abundance estimates for steelhead within lower Clear Creek are unknown. However, it is anticipated that juvenile steelhead abundance will increase due to the removal of McCormick-Saeltzer Dam. Juveniles may be exposed to stressful temperatures and flow fluctuations during June through September. However, in the worse case (90% exceedence forecast) daily temperature fluctuations of five degrees above the predicted average monthly model would still be within the preferred range of less than 65°F. Therefore, in the summer months a stable flow pattern that stays within the specified temperature compliance point should increase the likelihood that juvenile steelhead will survive.

Spring-run Chinook salmon juveniles in the Sacramento River Basin exhibit two different life history strategies. Most juveniles enter saltwater as sub-yearlings and are typically migrating downstream 60-150 days post-hatching during the spring. Other juveniles remain in freshwater through the spring and summer months and emigrate the following fall as yearlings. Emigration of yearling spring-run Chinook juveniles from the upper Sacramento River and its tributaries typically occurs October through March, with peak movement in November and December (DFG 1998). In Clear Creek, both juvenile life history strategies may be represented. Predicted flows in Clear Creek are expected to provide suitable depths and velocities for juvenile spring-run Chinook salmon rearing and emigration between October and March. Predicted water temperatures in all cases are expected to be within, or below, preferred temperatures (50°F to 60°F) for juvenile spring-run Chinook salmon rearing and emigration between October and March.

B. Sacramento River

1. Adult Migration, Spawning, and Incubation

In WY 2002 to 2004 (90/75% exceedence forecast) Reclamation proposes to release the minimum flow 3250 cfs from Keswick Dam to the upper Sacramento River from November through March. The February 15, 2002 forecast shows the minimum 1.9 MAF carryover specified in the WRO for Shasta end-of-September storage is met. In the 50% exceedence forecast, Reclamation proposes to release 5,000 cfs in March, 8,000 cfs in April, and 8,200 cfs in May. Actual daily releases may fluctuate from these monthly averages, particularly during flood control operations. Minimum releases from Keswick Dam will not drop below 3,250 cfs. Both forecasts have high flows ranging from 10,000 to 13,000 cfs, during the summer months consistent with the AFRP flow targets for the upper Sacramento River. Predicted monthly average temperatures between Keswick Dam and Red Bluff during 2002 through 2004 generally range from 44°F to 58°F under all exceedence forecasts.

Steelhead adults migrate upstream in the Sacramento River during all months except during April, May and June when they typically return downstream to the ocean. Specific information regarding steelhead spawning within the Sacramento River is limited. However, adult steelhead in the Sacramento River Basin typically spawn from December through April with peak activity occurring from January through March (Hallock et al. 1961 op cit. McEwan and Jackson 1996). Keswick Dam releases of 3,250 to 3,800 cfs combined with tributary accretions are expected to provide adequate depths and velocities for upstream passage and for spawning based on fall-run Chinook salmon habitat criteria developed by DFG for this area (DWR 1993). Predicted average monthly temperatures are within the range of preferred spawning temperatures for steelhead.

The extent of spring-run Chinook salmon spawning in the mainstem of the upper Sacramento River is unknown. Spring-run Chinook salmon adults migrate above RBDD towards Keswick Dam as they seek cooler water within the suitable temperature range for spawning (<56F). Spring-run Chinook salmon adults in the upper Sacramento River spawn primarily in September, and emergence of fry is expected during December and January. Relatively stable releases from Keswick Dam during the period of September through November are maintained for temperature control (WRO) and salmon spawning, which avoid scouring and dewatering of redds. Approximately 75 percent of the annual adult spring-run Chinook spawners passing RBDD have experienced delayed passage due to gate closures from July through August (CH2MHILL 2001). These spawners have trouble finding the ladders at RBDD because of the high flows being released from Keswick Dam at that time. Delays to upstream migration at RBDD can mean that some tributaries upstream will be blocked due to thermal barriers and low flows that develop by late summer. This may limit the available spawning habitat to spring-run adults, decrease spawning success, and subsequent genetic diversity. Other consequences of delayed passage at RBDD may result in changes in spawning distribution leading to increased hybridization with fall-run Chinook salmon, increased adult pre-spawn mortality, and decreased egg viability, which would result in the repeated reduction of annual recruitment of this species (CH2MHILL 2001).

Predicted daily average water temperatures in the upper Sacramento mainstem between Keswick and Bend Bridge are below 56°F in the 50% forecasts and, thus, within the preferred range for spring-run Chinook salmon spawning and incubation. In the 90/75% forecasts water temperatures are within the preferred range only to Jelly's Ferry, but most of the spring-run spawning in the mainstem occurs above this point. Predicted monthly average temperatures in the upper Sacramento River are generally below or within the range of suitable incubating and emergence temperatures (48°F - 52°F) from December through March. Cooler temperatures during these months are likely to slow the development of incubating eggs and pre-emergent fry resulting in a longer incubation period, but are not expected to affect survival.

During the period of steelhead egg and larval incubation (includes December through May), some large flow releases from Shasta and Keswick dams to the upper Sacramento River may be required for flood control and safety of dams criteria. Extremely high flow events have the potential to scour steelhead redds and result in the injury and mortality of steelhead eggs and sac-fry. Redds constructed during high flow releases may be dewatered when releases return to the projected forecast schedule. However, most releases made from Shasta Dam to avoid encroachment into the reservoir flood pool are not expected to scour or damage steelhead redds due to the short term nature of such events and the capacity of Shasta Reservoir to dampen high flows compared to pre-dam conditions. The extent of redds lost or damaged by dewatering is expected to be minimal under most circumstances unless very high flows are sustained for several weeks followed by the minimum release of 3,250 cfs. Isolation and stranding may also occur to spring-run Chinook salmon sac-fry from high flow events during December and January, but the probability of this effect occurring is very low given the low flows forecasted for this time period.

2. Fry, Juveniles, and Smolts

For fry and juvenile steelhead and spring-run Chinook salmon, water temperatures between 45°F and 65°F for steelhead and between 50°F to 60°F for spring-run Chinook salmon are preferred for growth and development. Predicted monthly average temperatures in the mainstem Sacramento River from December through January are within the preferred temperature range for rearing steelhead and are either slightly below or within preferred temperatures for rearing spring-run Chinook salmon.

The ramping criteria for Keswick Dam releases to the Sacramento River established in the WRO remains in effect through March 31 of every year. This ramping criteria is expected to minimize or eliminate impacts to steelhead and spring-run Chinook fry and juveniles from stranding and dewatering. Ramping down of flows occurs primarily at night when fish are typically more active and less likely to become isolated in pools or side channels. In addition, releases are reduced at very slow rates over several nights allowing adequate opportunities for fish to pass from shallow near shore areas and pools into the mainstem of the river.

In February 2001, flows were increased after a Spring Creek Debris Dam spill and Reclamation instituted a monitoring program for the associated ramp down in accordance with the 1993 WRO. The results of this monitoring indicated no juvenile winter-run Chinook salmon were found, however juvenile rainbow trout and spring-run size salmon were observed isolated in several side channels (February 5, 2001 letter from Reclamation to NOAA Fisheries, Sacramento). It is unknown if these fish survived until flows increased and reconnected the side channels.

Steelhead juveniles and smolts may emigrate from the upper Sacramento River over a prolonged period (October through early July) (McEwan and Jackson, 1996; SARI 1997, as cited in DWR and Reclamation 2000). Spring-run yearlings may emigrate from the upper Sacramento beginning in October and extend through February while sub-yearlings may begin in December and continue through May. Predicted monthly average temperatures in the upper Sacramento River are within the preferred temperature range for steelhead and spring-run Chinook salmon smolts from November through June. Also, predicted flows within the upper Sacramento River are expected to provide suitable depths and velocities for emigrating juvenile steelhead and spring-run Chinook salmon due to the high summer time flow pattern. Flows are not predicted to drop below the minimum instream flow requirements during the low flow period (November through February).

A substantial resident rainbow trout population predominates in the upper Sacramento River above Red Bluff due to stable cool summer flows released from Keswick Dam for winter-run Chinook salmon temperature control. The greater productivity from these releases may allow an increased growth rate among resident trout, which may skew the steelhead population towards non-anadromous forms (McEwan 2001). Recent studies on large controlled rivers suggest that resident rainbow trout have a selective advantage in upstream areas close to dams because they grow faster and out-compete young steelhead (Cramer 2000). Therefore, the change in habitat conditions below Keswick Dam may favor a resident trout population.

C. American River

1. Adult Migration, Spawning, and Incubation

From March 2002 to March 2004, Reclamation proposes to release on average 2,000 to 4,800 cfs from Nimbus Dam to the American River under the 50% exceedence forecast, and 850 to 3,000 cfs under the 90/75% exceedence forecast. Actual daily releases may fluctuate from these monthly averages, particularly during flood control operations. This flow schedule is consistent with the AFRP flow targets for the LAR. Low flow releases (1,500 cfs) in the winter of 2001 and 2002 may have contributed to a decrease in steelhead spawning by exposing redds in shallow water to trampling from anglers and repeated catch and release of adults on redds. Steelhead redds made in January 2001, at 1,750 cfs would be dewatered at these significantly decreased flows (850 cfs in March). Flow fluctuations occur routinely during critical spawning and rearing periods and have the potential to cause significant losses of juvenile steelhead and salmon (Snider 2001). Controlled decreases in flow during the late-winter and early spring can dewater steelhead redds and reduce the survival of eggs and sac-fry still in the gravel.

Predicted water temperature forecasts for WY 2002-2003 using weekly averages in the Cold-Water Pool Management Model (CPMM) predicted lethal temperatures for steelhead from May through September (69°F to 75°F) in the 90/75% alternatives and 64°F to 66°F upper summer time limits in the 50% alternatives. Water temperatures modeled balanced the needs of steelhead in the summer with fall-run Chinook salmon in the fall. The model included the area from Nimbus Dam down to the Watt Avenue Bridge for the following four alternatives:

1) 50% Forecast 2002-2003 - Shutters raised June, August, and November
2) 50% Forecast 2003-2004 - Shutters raised June, July, and November
3) 90/75% Forecast 2002-2004 - Shutters raised June and July
4) 90/75% Forecast 2003-2004 - Shutters raised July and November

All modeled releases below 11,000 cfs are through the power penstocks without blending releases through the lower river outlets or spillway gates.

Forecast Alternatives 1 and 2 represent a schedule of reasonably achievable LAR water temperatures assuming releases are not constrained by either Folsom Dam or penstock operation. Blending of water temperatures and shutter operations usually begins in September to meet the target of 65°F downstream to Watt Avenue. Alternatives 3 and 4 assume shutter operations (without blending) would begin in the summer to benefit steelhead and that a sufficient cold-water pool is available for fall-run Chinook salmon.

Adult steelhead in the American River typically migrate from November through April, and peaks from December through March (McEwan and Jackson, 1996; SWRI 2001a and b). Predicted weekly average temperatures in the LAR are within the range of preferred migrating temperatures (46°F to 52°F) from December through March in all four alternatives. Forecasted flow conditions in the 50% forecast are expected to provide suitable depths and velocities for upstream passage and spawning of adults within the LAR based on instream flow studies (FWS 1997). In the 90/75% forecast usable spawning area is reduced by 20% due to predicted low flows. This could significantly reduce steelhead spawning success and result in increased egg retention (SWRI 2001a). The population of steelhead in the action area is likely to experience a decline in recruitment as the other tributaries are similarly impacted by dry conditions until the hydrology improves.

Steelhead spawning in the American River typically occurs from December through April (McEwan and Jackson, 1996; SWRI 2001a), but may occur as late as June in some years (Snider 2001). Predicted weekly average temperature from Nimbus Dam to Watt Avenue are within the range of preferred spawning temperatures until April in the 50% forecasts (2002-2004). Since the peak of steelhead spawning season usually occurs in January and February, NOAA Fisheries does not consider this will significantly decrease spawning success. However, in the 90/75%, dry year forecasts steelhead spawning could be reduced due to high temperatures in March and April, which may be significant if spawning is delayed during the normal peak period due to high temperatures.

Egg incubation to emergence of steelhead fry includes the period from December through May. Predicted weekly average temperatures within the LAR exceed the range of preferred incubating and emergence temperatures (48°F to 52°F) from March through May in all the alternatives modeled. Since the peak of fry emergence generally occurs from March to June (Snider and Titus 2000), this could significantly decrease steelhead fry survival. In order to reduce the effect of high temperatures in the spring the first set of shutters on Folsom Dam were pulled early in May 2001 to increase survival of steelhead and salmon fry that had spawned late in the year. This action had to be balanced by the AROG against reducing the capacity of the cold water pool later in the year for fall-run Chinook salmon and steelhead spawning.

During the period of steelhead egg and larval incubation (includes December through April), large flow releases from Folsom and Nimbus dams to the LAR may be required by Reclamation for flood control and safety of dams criteria. Extremely high flow events have the potential to scour steelhead redds and result in the injury and mortality of steelhead eggs and sac-fry. Use of a COE proposed *Modified Rule Curve* for the enlargement of the Folsom Dam outlets would limit flood releases to 60% of inflows and provide some measure of protection against scouring below Nimbus Dam as well as providing a slight temperature benefit (COE 2001). Most releases from Folsom Dam to avoid encroachment into the reservoir flood pool will not create high velocity, scouring flow conditions in the LAR that are likely to damage steelhead redds. However, redds constructed during high flow releases may be dewatered when releases return to the projected forecast schedule. The extent of steelhead redds lost or damaged by dewatering is not easily quantified, but rapid and large flow fluctuations are known to expose steelhead and Chinook salmon redds in the early winter months (DFG 1993, Snider 2001). Modeling results indicate that the spawning bed materials begin to be mobilized at 50,000 cfs or greater (Ayers 2001), therefore the highest forecasted flows (5,000 cfs in February) are not expected to scour redds.

Spring-run Chinook salmon historically occurred in the South, North and Middle forks of the American River (DFG 1998). Following years of ineffective or absent fish ladders at the historic Folsom Dam, upstream access was completely blocked when the present-day Folsom and Nimbus dams were constructed. Due to the absence of cold water pools in the LAR for over-summering, adult spring-run Chinook salmon no longer exist in the American River. However, the LAR could be important non-natal rearing habitat for juveniles. The recurrent presence of both juvenile spring-run and winter-run sized salmon in December at the Watt Ave screw trap suggests that the LAR could be used for non-natal stream rearing. Monitoring in other tributaries of the Sacramento River has shown this to be a common life-history trait (Maslin 1997). Also, following large flood control releases in 1997 and 1998, 102 juvenile spring-run sized Chinook salmon were found in ponds isolated from the LAR (Snider 2001). Therefore, NOAA Fisheries expects a small number of juvenile spring-run Chinook salmon will be loss from isolation and stranding in winter months, however these numbers are not expected to be large enough to adversely affect the CV population.

2. Fry, Juveniles, and Smolts

Reclamation proposes to use ramp down criteria developed by the AROG and revised in the subsequent biological opinions to reduce the incidence of stranding relative to past operations. Reclamation has also provided funding for a flow fluctuation study conducted by DFG to better define release patterns on the LAR. Results of the flow study indicate that the aquatic habitat most affected by changes in flow below 4,000 cfs tends to be low profile banks and mid-channel bars (Snider 2001). A few isolated ponds may be created on these low profile banks and mid-channel bars by reductions in flow from 4,000 cfs to 1,750 cfs. Low profile bars are sensitive to small decreases in stage that can de-water or partially de-water the slopes of the bars. Steelhead fry present along low profile gravel bars or in side channels/pools will generally avoid stranding with the current ramping criteria, but a minimal amount of stranding is expected. Juvenile steelhead, given their size and swimming ability, are expected to have adequate opportunity with the slow ramping rate to leave the affected area in advance of stranding. However, releases for flood control (greater than 20,000 cfs) are above the ramping criteria and flows below Nimbus Dam can fluctuate widely during flood control operations. Flow fluctuations currently implemented during flood control operations by Reclamation may decrease survival of fry and juvenile steelhead through stranding and isolation. Potential loss of juvenile steelhead in the LAR based on areas sampled for each of the years 1997, 1998 and 1999 was estimated at 283,073; 42,979; and 10,893 fish respectively (Snider 2001). Loss from a single controlled flow reduction (6,000 cfs to 2,400 cfs) in late May of 2000, was estimated at over 7,000 juvenile steelhead. These annual losses may reduce the CV steelhead juvenile population of wild fish from 2 percent to 50 percent depending on the number of flow reductions per year (Appendix 1).

For juvenile steelhead rearing, water temperatures between 45°F and 65°F are preferred for growth and development. Predicted weekly average temperatures in the LAR are less than 65°F in the 50% forecasts (Alternatives 1 and 2), but can reach 75°F (usually considered lethal) during the summer and fall in the 90/75% forecasts (Alternatives 3 and 4). Most of the literature reviewed indicated that temperatures above 60°F induce varying degrees of chronic stress in juvenile steelhead based on Pacific Northwest stocks (Bovee 1978; Reiser and Bjornn 1979; and Bell 1986). Water temperatures in excess of 55°F inhibit formation and decrease activity of gill (Na+ and K+) ATPase activity in steelhead, with concomitant reductions in migratory behavior and seawater survival (Zaugg and Wagner 1973, Adams et al. 1975). However, recent monitoring in July and August indicated that steelhead growth and survival were not limited by temperature in the LAR, in that steelhead with good condition (i.e. K) factors persisted in water downstream of Watt Ave where daily average temperatures exceeded 72°F (DFG, Titus 2001, unpublished). In addition, growth studies at a U.C. Davis laboratory performed with Nimbus strain steelhead indicated the optimal feeding and growth temperature for juveniles was 68°F (Cech and Myrick 1999).

Several years of juvenile salmonid emigration studies in the LAR indicate large numbers of steelhead fry move downstream from March through June while steelhead yearlings and smolts emigrate from late December through February (Snider et al. 1997; 1998; and 2001). Predicted flows in the LAR are expected to provide suitable depth and velocity conditions for emigration based on DFG trapping data, FWS instream flow data, and assuming AFRP flow objectives are met. However, the quality and quantity of steelhead rearing habitat available during the summer will be significantly reduced in low flow years (less than 1,000 cfs in 90/75% exceedence forecasts). Therefore, NOAA Fisheries expects reduced numbers of CV steelhead and reduced survival in the LAR in low flow years.

D. Stanislaus River

1. Adult Migration, Spawning, and Incubation

From March 2002 through March 2004, forecasted flows will range from 225 to 1,500 cfs from New Melones Reservoir to the Stanislaus River under the 50% exceedence forecast and 125 to 1,100 cfs under the 90/75% exceedence forecast. Actual daily releases may fluctuate greatly from these monthly averages, particularly during flood control operations or when Vernalis water quality standards must be met on the San Joaquin River. Minimum releases from New Melones will reduce flows in the lower Stanislaus River below 300 cfs. Predicted monthly average temperatures between Goodwin Dam and the confluence with the San Joaquin River range from 45°F to 70°F under all exceedence forecasts.

Steelhead adults migrate upstream in the San Joaquin River during the period between January and June to spawn and are likely to enter into the Stanislaus River during the same period. Under the 50% and 90% exceedence forecasts, predicted monthly average temperatures from January through April, between the mouth of the Stanislaus River and Goodwin Dam (RM 58.5), are generally within the range of preferred migrating temperatures for steelhead (46°F to 52°F). New Melones releases of 125 cfs or greater are expected to provide adequate depths and velocities for upstream passage of migrating adults due to the presence of fall-run Chinook salmon spawning below Goodwin Dam and pulse flow releases in April and May for the VAMP experiments.

Specific information regarding steelhead spawning within the Stanislaus River is lacking. Based on observations of fall-run Chinook salmon spawning and available habitat, steelhead spawning in the Stanislaus River may occur in the reach between Oakdale (RM 41.2) and Goodwin Dam (RM 58.5). Spawning is likely to occur from December through June with peak activity from January through March. Predicted monthly average water temperatures between Oakdale and

Goodwin Dam are within the range of preferred spawning temperatures (39°F to 52°F) from December to February, but during March and April water temperatures are higher than preferred from the mouth to Oakdale. However, steelhead adults are not expected to spawn below Oakdale and will be exposed to these high temperatures only for a short duration as they migrate upstream. New Melones releases of 125 cfs to 300 cfs are expected to provide adequate depths and velocities for steelhead spawning and incubation based on instream flow incremental methodology (IFIM) studies (Aceituno 1993) and NMIPO fishery flow objectives.

During the period of steelhead egg and larval incubation (January through May), large flow releases from New Melones Reservoir to the lower Stanislaus River may be required for flood control and *safety of dams* criteria. However, large releases from New Melones Dam to avoid encroachment have a low probability of occurrence, due to the large storage capacity and low refill potential of the reservoir (20 percent in a median year). Redds constructed during high flow releases may be dewatered when releases return to the projected forecast schedule. The number of redds lost or damaged by dewatering is expected to be few, under most circumstances, due to expected ramping rates and minimum flow criteria specified in the NMIPO.

2. Fry, Juveniles, and Smolts

In the absence of data regarding ramping of stream flows on the Stanislaus River, Reclamation has adopted ramping criteria developed for the Trinity River since channel characteristics and hydrology are similar. Depending on the magnitude and/or duration of flow fluctuations, there is a potential for fry and juvenile steelhead to become isolated or stranded. New Melones proposed releases of 125 cfs to 300 cfs are expected to provide adequate depths and velocities for juvenile steelhead rearing based on IFIM studies (Aceituno 1993) and NMIPO fishery flow objectives.

For fry and juvenile steelhead, water temperatures between 45°F and 60°F are preferred for growth and development. Predicted monthly average temperatures in the lower Stanislaus River from October through May are generally within the preferred temperature range for steelhead. However, from June through September, predicted water temperatures range from 55°F to 70°F. These predicted temperatures during the summer are within the range of chronic low stress temperatures that may decrease foraging behavior in juvenile steelhead (Leidy 1987). Thermal stress induces varying degrees of physiological responses that may result in an increased susceptibility to disease, predation, and/or other secondary mortality factors (Reiser and Bjornn 1979, Boles et al. 1988). However, as mentioned previously, growth studies at UC Davis indicate that the optimal feeding and growth temperature for other Central Valley steelhead was 68°F. High summer temperatures may create additional habitat for warm water predator species within the Stanislaus River.

Emigration of smolts in the Stanislaus River has been observed from April through June (Cramer 1998, 1999, 2000; McEwan 2001), but is likely to occur during October through March as well depending on flow and temperature conditions. The preferred temperatures for smoltification are less than 57°F (McEwan and Jackson 1996). Water temperatures above of 55°F inhibit formation and decrease activity of gill (Na+ and K+) ATPase activity in steelhead, with concomitant reductions in migratory behavior and seawater survival (Zaugg and Wagner 1973, Adams et al. 1975). Predicted monthly average temperatures are within the preferred smoltification temperatures for juveniles from November through May. From May through September, predicted water temperatures will significantly exceed the preferred temperature range for smoltification. Steelhead are not expected to migrate as smolts when the predicted water temperatures exceed 60°F from May through September. Steelhead that have not emigrated downstream to the Delta and ocean prior to this rise in water temperature during May and June are expected to take up residence in the Stanislaus River. The effects associated with this behavior and delay in emigration to the ocean are unknown. However, available habitat above Oakdale is expected to provide sufficient cool water for steelhead to oversummer. Although predicted flows within the lower Stanislaus River are very low during the winter and summer months, pulse flows released during spring storms, VAMP spring flows, and water quality control releases are expected to increase flows above the minimum criteria and improve smolt emigration during this period.

The proposed fisheries monitoring program for Chinook salmon using rotary screw traps (RSTs) in the Stanislaus River is expected to capture small numbers of juvenile steelhead. Based on past sampling at Oakdale and Caswell State Park, approximately 50 to 60 steelhead smolts and pre-smolts are expected to be: captured, measured, rated for smolting characteristics, and released below the trapping site.

Previous sampling experience with RSTs in the Stanislaus River indicates that all captured steelhead will be maintained in good physical condition and released unharmed back into the river. RST monitoring is expected to have little effect on the Stanislaus River steelhead due to the low number of steelhead captured, lack of mortality in past sampling, and adherence to sampling/handling protocols that minimize stress and harm.

E. Feather River

1. Adult Migration, Spawning, and Incubation

From March 2002, through March 2004, DWR proposes to release between 900 and 7,000 cfs from Oroville Dam to the Feather River under the 50% exceedence forecast and 800 to 4,800 cfs under the 90/75% exceedence forecast. A constant 600 cfs of this release will pass through the Thermalito Diversion Dam Powerplant into the low flow section of the Feather River. The low flow section is approximately 8 miles long and extends from the Fish Barrier Dam downstream to the Thermalito Afterbay Outlet. The remainder of the release to the river will pass through Thermalito Forebay and Afterbay to be released at the Thermalito Afterbay Outlet. Actual daily releases may fluctuate from these monthly averages, particularly during flood control operations. Minimum releases in the Feather River below the Thermalito Afterbay Outlet may drop below the 1,700 cfs minimum flow established in the August 1983 agreement between DWR and DFG, *Concerning the Operation of the Oroville Division of the State Water Project for Management of Fish & Wildlife.* Currently, releases in 2002 are expected to remain at 1,200 cfs until June.

Flows of 600 cfs in the low flow channel are expected to provide adequate depths and velocities for upstream passage and spawning of steelhead based on fall-run Chinook salmon spawning. The proposed flow regime of a constant 600 cfs in the low flow channel probably restricts normal stream channel forming processes and the development of well-vegetated side channel areas that would provide valuable steelhead spawning habitat. Limited observations to date suggest that steelhead spawning habitat may be limited to only one area directly below the hatchery (hatchery ditch) which is further limited by redd superimposition from fall-run Chinook salmon (Sommer et al. in DFG 2001). However, predicted average monthly temperatures within the low flow channel are generally within preferred spawning temperature range for steelhead during the steelhead spawning season. For the steelhead incubation and emergence period, predicted monthly average temperatures are generally within a suitable range in the low flow channel.

Predicted cooler temperatures near the upper end of the low flow channel during the summers of 2002-2004 are likely to provide suitable holding conditions throughout the summer months and provide the coldest water available during September for the initiation of spawning. For spring-run Chinook salmon, spawning primarily occurs during September and emergence of fry from redds is predicted for December and January. Stable releases of 600 cfs within the low flow channel during the incubation period will likely provide flow conditions which avoid scouring and dewatering of redds based on low reservoir storage in 2001 and forecasted low storage in 2002.

During steelhead egg and larval incubation (December through March), infrequent high flow releases from Oroville Dam to the low flow channel of the Feather River may be required for flood control and *safety of dams* criteria. Oroville Dam releases in excess of 17,000 cfs must be released to the low flow channel, rather than Thermolito Afterbay, because the powerplants associated with the Thermalito Complex have a capacity of approximately 17,000 cfs. High flows in the low flow channel have the potential to scour steelhead redds and result in the injury and mortality of steelhead eggs and sac-fry. In contrast, downstream of the Thermalito Afterbay Outlet, the frequency of flow fluctuations is much greater than in the low flow channel (DWR 2002), therefore, steelhead redds constructed in the high flow channel may be dewatered when releases return to the projected forecast schedule. However, the extent of redds lost or damaged by dewatering below Thermalito is expected to be minimal under most circumstances, because the majority of steelhead and spring-run Chinook salmon spawn in the low flow channel where flows remain at a constant 600 cfs.

2. Fry, Juveniles, and Smolts

For fry and juvenile steelhead and spring-run Chinook salmon, water temperatures between 45°F and 65°F are preferred for growth and development. Monthly average temperatures in the mainstem Feather River are predicted to exceed the preferred temperature range for both species during the period between June and September 2002-2004. Predicted temperatures are within the range of chronic low stress temperatures that may reduce the likelihood of survival for juvenile steelhead and spring-run Chinook salmon. Thermal stress induces varying degrees of physiological responses that may result in an increased susceptibility to disease, predation, and/or other secondary mortality factors (Reiser and Bjornn 1979; Boles et al. 1988). Also, rising temperatures may create additional habitat for warm water predator species within the Feather River and/or increase their metabolic requirements resulting in increased potential predation rates on salmonids. Recent temperature studies on the Feather River indicate that steelhead rear successfully at the downstream end of the low flow section (Robinson Riffle) where summer temperatures exceed 65°F (DWR 2001). Also, a laboratory study on Feather River steelhead found in-channel naturally produced steelhead displayed a higher thermal tolerance than steelhead from the FRH (Myrick 2000). These studies suggest that CV steelhead may not be harmed from expected high water temperatures.

Ramping criteria for the Feather River were established by a 1983 agreement between DWR and DFG. This agreement requires flows below Thermalito Afterbay that are under 2,500 cfs to be reduced by no more than 200 cfs during any 24-hour period, except for flood control, failures, etc. This ramping criteria is expected to minimize or eliminate impacts to steelhead and spring-run Chinook fry and juveniles from stranding in areas below the Thermalito Afterbay. Flood control operations above 5,000 cfs may result in rapid and large flow fluctuations within the low flow channel and the river below the Afterbay Outlet. Depending on the magnitude and/or duration of these flow fluctuations, there is a potential for fry and juvenile steelhead to become stranded. Flow fluctuations for flood control operations in the past have resulted in the stranding of juvenile salmon in broad shallow pools on the flood plain near Nelson Slough (CALFED ERP vol. 2, 1999) and potentially in the Robinson gravel pit. Current stranding and isolation studies have shown no loss of steelhead or spring-run Chinook salmon in the low flow section due to flow fluctuations. However, in the high flow section salmon redds (presumably fall-run) are routinely dewatered and juvenile salmon and steelhead have been found stranded in 19 areas (Sommers 2001). The estimated number of redds dewatered and juveniles stranded in the high flow section appears insignificant, since the majority of spring-run Chinook salmon and steelhead spawn in the low flow section below the FRH (note: no distinction can be made between fall-run and spring-run Chinook salmon due to similar appearance and spawning period). It is also likely that a large proportion of stranded salmonids may be rescued by subsequent increases in flows.

Chinook salmon emigration studies in the Feather River from 1995 through 2001 have incidentally captured YOY and yearling steelhead. YOY steelhead were captured from March through June, whereas yearlings were captured January through June. Previous sampling by DWR in the Feather River indicates that captured steelhead, and spring-run Chinook juveniles will be maintained in good physical condition and released unharmed back into the river. Steelhead were not captured during the period between October and December, but researchers speculated that steelhead may not have been vulnerable to the sampling gear, during this time rather than their apparent absence (DWR1999a; DWR 1999b; DWR 1999c; DWR 2000). Based both on these results and steelhead emigration patterns in the Sacramento River, steelhead juveniles and smolts are expected to emigrate from the Feather River to the lower Sacramento River and Delta from December through May. RST data from the 1999-2000 sampling season showed most juvenile steelhead emigrate below Thermalito Afterbay from March through April (DWR, unpublished data). Predicted flows in the Feather River are expected to provide adequate depths and velocities for steelhead rearing and emigration during this period of December through April, because of the stable flow pattern (600 cfs) and presence of juveniles in DWR trap data. Predicted temperatures in the Feather River are expected to be within, or below, the preferred range for steelhead rearing and emigration during the period of December through April.

Steelhead are not expected to migrate as smolts when the predicted water temperatures exceed 60°F from May through September. The preferred temperatures for smoltification are less than 57°F (McEwan and Jackson 1996). Steelhead smolts that have not migrated by the end of spring are expected to reside in the low flow channel where cooler water provides refugia for over-summer rearing. Hatchery and wild juvenile steelhead share the same available habitat in the low flow channel. In 2001, FRH steelhead released at Live Oak, were observed five miles upstream on the Yuba River two weeks after being released. Some of these FRH steelhead are expected to return to the low flow channel and compete with in-river produced juveniles for food and space. This may reduce the growth rates of wild juveniles as well as increase their vulnerability to predators, which may in turn reduce the number of wild adults that subsequently return to spawn.

Results from the Feather River Chinook salmon emigration studies indicate virtually all spring-run Chinook salmon juveniles in the Feather River exit as sub-yearlings. Emigration of YOY spring-run Chinook salmon begins immediately following their emergence in late November, peaks in December or February, and continues through May (DWR 1999a; DWR 1999b; DWR 1999c; DWR 2000). Assuming a stable flow pattern (i.e., due to low storage and low refill potential of Oroville Reservoir), predicted flow conditions in the Feather River from March 2002 through March 2004 are expected to provide adequate depths and velocities for rearing and emigration of spring-run Chinook salmon juveniles, as suggested by the 1999-2000 RST data (DWR 1999a-c; DWR 2000). Predicted water temperatures in the Feather River from November 2002, through April 2004, are expected to be within, or below, the preferred range for rearing and emigration of spring-run Chinook salmon juveniles.

F. Sacramento-San Joaquin Delta

During December through May, the Delta provides habitat for steelhead by: (1) serving as a corridor for upstream migrating adults returning to freshwater to spawn; (2) serving as a corridor for juveniles migrating downstream to the ocean; and (3) short-term rearing habitat for juveniles as they move downstream. For spring-run Chinook salmon, the Delta also serves these three purposes during the period between December and March, but most adult upstream migrants would be expected to pass through the Delta after March 31 each year.

From March 2002 through March 2004, Reclamation and DWR propose to operate the Delta export pumps and Delta Cross Channel gates in compliance with: SWRCB permits; existing biological opinions for winter-run Chinook salmon and delta smelt; the 1995 Bay-Delta Water Quality Control Plan (D-1641); and all CVPIA/AFRP (b)(2) Delta actions. Recent Delta export operations under the 1995 Water Quality Control Plan and AFRP actions have caused a shift in pumping from the spring months to the fall and winter period. Under the 50/90/75% exceedence forecasts, the export pumps will be operated significantly below the maximum export-to-inflow (E/I) standards from April through September and slightly below these standards from November through March. At any time there is an opportunity to relax the E/I ratio when fish salvage densities are low, Reclamation and DWR may exercise their flexibility to pump water for the EWA after agreement from NOAA Fisheries, FWS and DFG.

1. Adult Migration

From November through May, adult steelhead and spring-run Chinook salmon will migrate through the Delta for access to upstream spawning areas in the Sacramento and San Joaquin basins. Changes in Delta hydrodynamics from CVP and SWP export pumping in the south Delta are expected to affect the ability of adult steelhead and spring-run Chinook salmon to successfully home in on their natal streams. Recent radio tagging studies on adult fall-run Chinook salmon indicate that these fish frequently mill about in the Delta, often initially choosing the wrong channel for migration (DFG, in IEP Workshop 2002). CVP and SWP export pumping alters Delta hydrodynamics by reducing total Delta outflows by as much as 14,000 cfs and reversing net flows in several central and south Delta channels. Steelhead and spring-run Chinook salmon adults destined for the Sacramento Basin and the Mokelumne River may experience some minor delays during passage through the Delta by straying temporarily off-course in north and central Delta waterways. However, closure of the Delta Cross Channel gates from February 1 through May 20 every year will minimize diversion of Sacramento River water into the Central Delta and improve attraction flows in the mainstem. In addition, export curtailments in February and March to comply with the 35% E/I standard will significantly improve hydrodynamic conditions in Delta waterways by providing a more natural (i.e. westward) flow pattern.

In the south Delta, adult steelhead bound for the Stanislaus River could have difficulty detecting attraction flows to the lower San Joaquin River. As proposed, combined CVP and SWP export rates will significantly exceed San Joaquin River flow at Vernalis except during the VAMP pulse flow period (March 15 through May 15). Upstream passage of adult steelhead destined for the Stanislaus River may be delayed by export operations. In the worst case, returning adult steelhead may not find the lower San Joaquin River and stray into one of the Eastside streams, which include the Cosumnes, Mokelumne, and Calaveras rivers. The successful spawning and ultimate contribution to natural production of these strays is uncertain. Concerns about diminished attraction of adult salmon and steelhead to their home streams from excessive CVP and SWP exports have been expressed by Delta Fisheries researchers (Hallock et al. 1970, DFG 2001 Vol.2), and may account for the trend of low adult returns in some rivers.

2. Fry, Juveniles, and Smolts

Most steelhead outmigrants arriving in the Delta are smolts, and pass through relatively quickly (i.e., within one month) on their way to the ocean. Juveniles typically enter the Delta beginning in December and continuing through June, whereas yearlings (70-150 mm in length) migrate through the Delta from November through March, with peak migration occurring in December or January. Most steelhead smolts are two years old (200-300 mm in length). These fish are relatively large and have good swimming ability, enabling them to avoid predators and overcome reverse flow patterns in Delta waterways.

Pulse flow releases for VAMP from tributaries on the San Joaquin River (i.e. Stanislaus, Tuolumne and Merced Rivers) that coincide with reduced CVP/SWP export rates have been shown to significantly improve juvenile salmon out migration and survival rates (FWS 1991-2001). The expected continuation of VAMP along with (b)(2) releases on the Stanislaus River to meet water quality control standards in the San Joaquin River should significantly improve outmigration and survival of steelhead smolts.

As presented above for adult steelhead and spring-run Chinook salmon, changes in Delta hydrodynamic conditions associated with CVP and SWP export pumping inhibit the function of Delta waterways as migration corridors. Central and southern Delta channels, essentially have become conduits for carrying water to the CVP and SWP facilities. Export pumping rates proposed under both the 50% and 90% exceedence forecasts, and particularly under the 90% forecast, will create unnatural flow conditions in the central and south Delta. Net flows during December and January generally will be eastward (i.e. reverse flows) instead of westward in the lower San Joaquin River near Jersey Point. North of the CVP and SWP Delta pumping plants, net flows in Old and Middle rivers will be southward instead of northward. As a result of these changes in hydrodynamic conditions, some steelhead and spring-run Chinook smolts will be diverted from their primary rearing and migration corridors. Many individuals will arrive at the CVP and SWP fish salvage facilities while others are expected to be subjected to increased predation along the way. Mortality is expected to result from entrainment in 2,050 unscreened water diversions, predation, food supply limitations, elevated water temperature and poor water quality (DFG 1998). From February though May, export curtailments to comply with the 35% E/I standard will significantly improve hydrodynamic conditions in Delta waterways and increase survival rates over those experienced in December and January.

With mandatory closure of the Delta Cross Channel gates from February 1 through May 20 (pursuant to SWRCB D-1641), approximately 70 to 80 percent of the steelhead and spring-run Chinook salmon juveniles migrating downstream in the Sacramento River are expected to remain in the Sacramento River. These fish will be less subject to decreased survival rates through the Delta related to the effects of CVP and SWP Delta export pumping. The remaining 20 to 30 percent are expected to be transported into the Delta in direct proportion with the diversion of Sacramento River flow into Georgiana Slough. If the Delta Cross Channel gates are opened for water quality improvements or other purposes, a significantly greater proportion of Sacramento River flow and juvenile fish will be diverted into the central Delta.

Several years of FWS fisheries data indicate that the survival of salmon smolts in Georgiana Slough and the central Delta is significantly reduced when compared to the survival rate for fish that remain in the Sacramento River (FWS 1991-2001). Data from investigations conducted since 1993 with late fall-run Chinook salmon during December and January are probably the most applicable to emigrating steelhead and spring-run Chinook salmon yearlings. These survival studies were conducted by releasing one group of marked (i.e. CWT and adipose fin clip) hatchery-produced salmon juveniles into Georgiana Slough, while a second group was released into the lower Sacramento River. Results have repeatedly shown that survival of juvenile salmon released directly into the Sacramento River while the DCC gates are closed is, on average, eight times greater than survival of those released into the central Delta via Georgiana Slough (DFG 1998).

The results of these studies clearly demonstrate that the likelihood of survival of juvenile salmon, and probably steelhead, is reduced by deleterious factors encountered in the central Delta. Baker et al, (1995), showed that the direct effects of high water temperatures are sufficient to explain a large part (i.e. 50 percent) of the smolt mortality actually observed in the Delta. The CVP and SWP export operations are expected to contribute to these deleterious factors through altered flow patterns in central and south Delta channels. Under the 90/75% exceedence forecast, flow patterns are altered to a greater degree than in the 50% forecast and are expected to result in a higher level of impact to emigrating steelhead and spring-run yearling smolts. NOAA Fisheries believes that the adverse effects of this aspect of the proposed action on juvenile spring-run Chinook salmon and steelhead will be severe enough to reduce the number of adults returning to spawn in future years, thereby reducing the numbers and reproduction of this population.

Juvenile steelhead and spring-run Chinook salmon will be entrained at the CVP Tracy Fish Collection Facility and the SWP Skinner Fish Protection Facility. Mortality is expected to occur due to predation within Clifton Court Forebay at SWP only, entrainment through the primary and secondary louvers, and stress associated with handling and transportation.

The proposed AFRP (b)(2) Delta actions for December and January are expected to reduce impacts to emigrating steelhead and spring-run Chinook smolts in the Delta. These (b)(2) actions are designed to increase the survival of yearling spring-run Chinook salmon by reducing export levels at the CVP Tracy Pumping Plant and potentially the SWP Banks Pumping Plant when Delta Fisheries monitoring detects periods of increased vulnerability. Past Fisheries monitoring efforts and Delta fish salvage records indicate juvenile spring-run Chinook salmon and steelhead presence in the Delta is often episodic during December and January. Carefully timed periods of export curtailments or upstream releases are expected to improve Delta hydrodynamics and improve flow conditions during the (b)(2) action for emigrating smolts to successfully pass through the Delta into San Francisco Bay.

In addition to the AFRP (b)(2) Delta action, the CVP and SWP can implement the use of the EWA through the *Provisional Fall/Winter Juvenile Salmon Decision Process* (October through March) for export curtailments or upstream reservoir releases. Through increased fisheries monitoring and close scrutiny of fish salvage results, the DAT will track potential losses of yearling spring-run Chinook salmon with hatchery marked late fall-run Chinook salmon as surrogates. These late fall-run fish should serve as an appropriate surrogate for spring-run Chinook salmon losses because NOAA Fisheries expects these fish, which begin their emigration and smoltification passage through the Delta at approximately the same time and size as wild spring-run Chinook salmon, to be taken at the same rate as wild spring-run Chinook salmon. Therefore, conditions that result in the loss of one percent of the late fall-run Chinook salmon population are likely to have resulted in the loss of one percent of the CV spring-run Chinook salmon population.

G. Suisun Marsh Salinity Control Structure

Recent modifications to the flashboards at the SMSCS were designed to improve passage of adult salmon and steelhead when the facility is operated. Under the 50% and 75/90% exceedance forecasts, DWR proposes to operate the gates from September 1 through May 31 as needed to meet water quality control standards. The gates are opened twice each day on a tidal cycle. A three-year evaluation of upstream salmon passage indicated that modified slots instead of flashboards did not improve passage for salmon. Therefore, DWR and Reclamation decided to postpone further testing of the slots and reinstall the original flashcards. In 2001, modified operations of the SMSCS leaving the boat lock open resulted in increased adult passage and reduced delays. Further testing will continue in 2002 and 2003 to see if this pattern is repeated.

The infrequent occurrence of young steelhead and Chinook salmon in the Suisun Marsh monitoring program suggests that migration delays and associated predation are unlikely to significantly affect juvenile steelhead or spring-run Chinook salmon. Steelhead were not listed as prey items of striped bass or Sacramento pikeminnow captured near the facility between 1987 and 1993 (DWR 1997).

H. Rock Slough

During March 2002, through March 2004, operation of the unscreened Rock Slough intake at the Contra Costa Canal is expected to entrain some juvenile steelhead and spring-run Chinook salmon. Proposed diversion rates vary from about 150 cfs to 255 cfs. Rock Slough is located relatively far from the main migration route of Sacramento River salmon and steelhead juveniles, but the creation of reverse flow conditions by operation of the CVP and SWP pumping plants may bring some spring-run Chinook salmon and steelhead into the vacinity of the diversion. During the period from1994 through 1996, entrainment monitoring conducted by the DFG estimated 52 to 96 steelhead juveniles were lost per year compared to 1,300 to 4,500 salvaged at the Tracy and Banks Export Facilities during the same time. Additional loss may have occurred through predation near the dead-end slough at the intake to the canal. Although no losses of juvenile spring-run Chinook salmon or steelhead have been reported by DFG from 1997 to present (Morinaka 2002 unpublished), this may be due to the change in sampling location (i.e., from the pumping plant to the headworks) that was implemented in 1997. Additional losses of steelhead and spring-run Chinook salmon to predation are also likely to occur in the canal and in the vicinity of the Rock Slough intake. Thus, NOAA Fisheries expects that a small number of steelhead and spring-run Chinook salmon may be killed due to entrainment and predation at this facility.

I. Synthesis of Effects

The alteration of the hydrologic cycle due to CVP/SWP reservoir operations has the potential to decrease the survival of incubating and juvenile life stages of steelhead and spring-run Chinook salmon in the Sacramento River downstream of Shasta Dam, Clear Creek downstream of Whiskeytown Dam, Feather River downstream of Oroville Dam, American River downstream of Folsom Dam, and the Stanislaus River downstream of New Melones Dam. The majority of impacts in 2002-2004 will be due to increased temperatures and flow fluctuations upstream. In addition, unnatural flow patterns created by the operation of the DCC and by the CVP/SWP export facilities have the potential to delay and alter the routes of adult steelhead and spring-run Chinook salmon upstream migrants, and decrease survival rates of juvenile downstream migrants within the Delta. Direct entrainment of juvenile steelhead and spring-run Chinook salmon will occur in the Delta at the CVP/SWP export facilities and Rock Slough pumping plant. Finally, export facility operations may cause many outmigrating chinook salmon and steelhead to be directed into the central and south Delta, where they have a high rate of mortality. The potential amount and extent of adverse effects due to reservoir and export facility operations are difficult to predict because they are dependent on a variety of factors. However, we expect that the proposed Project will reduce the reproductive success of both species, and harm juveniles due to habitat degradation. The proposed Project is expected to reduce juvenile survival during 2002-2004, and also contribute to a pattern of mortality that has occurred for many years.

1. <u>Reservoir operations</u>

The potential for reservoir operations to result in redd scouring, redd dewatering, or juvenile stranding is dependent on precipitation patterns during the winter and spring months. Heavy rainfall is likely to trigger flood control operations at Central Valley reservoirs and result in short-term high flow events in the upper Sacramento River, Clear Creek, Feather River, American River and Stanislaus River. Reduced survival due to flood control operations will be difficult to detect because most dead or injured fish will be within the gravel substrate of the streambed, but decreased survival of eggs, larvae, and juveniles is reasonable to expect. In addition, project effects are likely to be influenced by a number of factors, including: 1) the number of spawning adults that contribute to juvenile production in each basin; 2) the location of spawning habitat used in each particular river reach; 3) the timing and duration of spawning (i.e., early in the spawning season versus late; spawning concentrated within a short time period versus protracted over several months); 4) duration required for egg incubation, which is dependent on a variety of factors including water temperature; and 5) the occurrence, magnitude, and duration of flood operations or low flow releases in relation to the presence and abundance of different life stages.

2. Delta operations:

Adverse effects to spring-run Chinook salmon and steelhead resulting from altered flow patterns created by the operation of the DCC and the CVP/SWP export facilities are difficult to detect and quantify. However, mark-recapture studies of juvenile salmon indicate that the survival of spring-run Chinook yearlings and steelhead smolts is reduced when fish are diverted from the mainstem Sacramento River into the central Delta. Reduced survival is likely a result of degraded habitat conditions in central and southern Delta waterways, increased residence time, predation from introduced species, longer migration route, reverse flows, altered salinity gradient, adverse water temperatures, increased contaminants, and food supply limitations (DFG 1998).

Adverse effects associated with entrainment at the CVP/SWP export facilities are more easily quantified. Direct losses of spring-run Chinook salmon yearlings can be quantified at the Tracy and Skinner fish facilities based on observations of salvaged CWT late fall-run chinook salmon surrogates. With adherence to the CALFED Operations Group, *ProvisionalFall/Winter Juvenile Salmon Decision Process*, it is anticipated that the incidental take of juvenile spring-run Chinook salmon at the export facilities will not exceed one percent of the population.

YOY spring-run Chinook salmon are expected to arrive in the Delta between January and June, and cannot be distinguished from natural fall-run Chinook salmon because of size overlap. However, a mixed stock analysis conducted by DWR from 1994 through 1998 showed that spring-run Chinook salmon only accounted for 0.13 percent of the total loss at the Delta Fish Facilities, whereas San Joaquin River and Sacramento River fall-run Chinook salmon accounted for 92.5 percent and approximately 7.4 percent of the total loss, respectively (DWR memo 1999). Applying these percentages to the actual number of YOY salmon taken at the Delta Fish Facilities indicates that between 15 and 164 YOY spring-run Chinook salmon were taken per year. This loss of YOY fish is small and therefore unlikely to affect the number of adults returning to spawn or otherwise have population-level effects. In addition, export reductions from April 15 through May 15 for the VAMP period will further minimize the loss of YOY spring-run Chinook salmon at the Delta export facilities.

An analysis of recent steelhead data from RBDD (FWS 2001), Chipps Island, and the Delta Fish Salvage Facilities indicate that the juvenile steelhead population seems to fluctuate within a natural range that is dependent on hydrology, rather than operations. Even though steelhead salvage data is highly variable, there appears to be a positive correlation between salvage and export rate (DWR and USBR 1999). Thus, it appears that steelhead salvage at the Delta Facilities is an indicator of juvenile year class strength.

Although entrainment of juvenile and adult steelhead will be monitored through salvage numbers at the Delta Fish Facilities, mortality estimates for steelhead are not available because the estimators for losses due to predation in Clifton Court Forebay, predation at Tracy fish facility, and entrainment through the primary and secondary louver systems were developed only for Chinook salmon. Existing information regarding steelhead predation losses and louver screening efficiency is insufficient to generate similar loss estimators for steelhead. However, the level of impact to steelhead smolts can be monitored from salvage estimates in prior years. Based on observations from 1992 to 2000, combined salvage of unmarked juvenile steelhead (<351mm) ranged from 395 to 17,730 fish during the December through June emigration period. Average number of unmarked juvenile steelhead salvaged over the eight-year period is 4,200 fish with a median of 2,327 fish (DFG 2001, unpublished data). Based on a conservative estimate of 3,576 adult steelhead for the Central Valley (see Appendix 1) the average number of juveniles salvaged at the Delta Fish Facilities represents less than one percent (4,652 juveniles) of the total natural population entering the Delta. NOAA Fisheries expects the actual loss associated with the Delta Pumping Plants to be less than the yearly number salvaged based on the larger size of steelhead smolts and therefore more efficient louver operation. Also, most juvenile steelhead salvaged at the Delta Fish Facilities survive the truck and haul operation and are released unharmed back to the Delta. Therefore, the loss at the pumps is not expected to greatly impact the CV steelhead population.

Additional mortality to juvenile steelhead and spring-run Chinook salmon may occur as a result of the operation of the unscreened Rock Slough intake of the Contra Costa Canal. Based on historical entrainment estimates at the Rock Slough Intake, mortality ranged from between 30 to 100 juvenile steelhead and 20 to 70 juvenile spring-run Chinook salmon in the Contra Costa Canal. These numbers represent an extremely low percentage of the overall steelhead and spring-run Chinook salmon populations.

J. Impacts on ESU survival and potential for recovery

Since 1995, NOAA Fisheries has developed the viable salmonid population (VSP) concept as a tool to evaluate whether the species-level requirements of the ESU are being met (McElhany et al. 2000). Each salmonid ESU may contain multiple independent populations. A viable salmonid population is defined as an independent population that has a negligible risk of extinction due to threats from demographic variation, local environmental variation, and genetic diversity changes over 100 years. The attributes used to describe a VSP include adequate abundance, productivity (i.e., population growth or cohort replacement rate), population spatial scale, and diversity.

1. Central Valley Steelhead.

According to McEwan and Jackson (1996), the annual run size for the CV steelhead ESU in 1991-92 was probably less than 10,000 fish based on RBDD counts, hatchery returns and past spawning surveys. At present, wild (i.e., naturally spawning) steelhead stocks appear to be mostly confined to upper Sacramento River tributaries such as Antelope, Deer, and Mill creeks and the Yuba River (McEwan and Jackson 1996). Naturally spawning stocks of rainbow trout that support anadromous populations are also known to occur in Butte Creek, the upper Sacramento, Feather, American, Mokelumne, Calaveras and Stanislaus Rivers (McEwan 2001). However, the presence of naturally spawning populations appears to correlate well with the presence of Fisheries monitoring programs, and recent implementation of new monitoring efforts has found steelhead in streams previously thought not to contain populations, such as Auburn Ravine and Dry Creek (IEP Steelhead Project Work Team 1999). It is possible that other naturally spawning populations exist in Central Valley streams, but are undetected due to lack of monitoring or research programs.

For steelhead within the Central Valley, there is limited data available for population estimates within any individual tributaries including those with CVP/SWP facilities. However, estimates of wild steelhead in the upper Sacramento River and American River were calculated in the early 1990s. In the upper Sacramento River, estimates for the period from 1967 to 1991 averaged 3,465 adults, based on RBDD counts that were corrected for harvest. This estimate includes adults that would spawn in areas of the upper mainstem Sacramento River as well as suitable tributaries above RBDD including Clear Creek. In the American River, run sizes of 305, 1,462, and 255 adults were estimated for the 90-91, 91-92, and 92-93 spawning seasons, respectively, based on escapement counts at the hatchery that were corrected for harvest (McEwan and Jackson 1996). In the Stanislaus River, a small, remnant run is recognized based on occasional observations of adults and downstream juvenile migrants by anglers and fishery biologists, respectively. Recent estimates of in-river produced juvenile steelhead by DFG for the upper Sacramento River based on rotary screw trap counts upstream from the mouth of the Feather River (i.e., at Knights Landing) were 11,586 for the 96-97 season and 8,634 for the 97-98 season (Snider and Titus 2000). In contrast, estimates based on the ratio of clipped to unclipped fish at Chipps Island and Sacramento indicated 100,000 juvenile steelhead were produced (FWS 2001 unpublished). Given the uncertainty of these estimates and the limited data available, the potential for CV steelhead recovery is unknown. However, NOAA Fisheries anticipates that the proposed project will not reduce the likelihood of survival and recovery of CV steelhead for the following reasons: First, data over the last five years from RBDD rotary screw trapping indicate the number of outmigrating steelhead /rainbow trout from the upper Sacramento River has remained stable and more closely reflects changes in hydrology than effects from operations (FWS 2001). Second, steelhead typically outmigrate through the Delta during periods when protective measures for spring-run and winter-run Chinook salmon, as well as for Delta smelt (a FWS listed species), are implemented by the CVP/SWP Delta facilities and will benefit from similar protection. Third, within the operations of each reservoir facility a great deal of flexibility exists that allows changes in operations during critical steelhead periods (i.e., spawning and egg incubation), which will depend on precipitation patterns and the decisions of various work groups. Fourth, the use of (b)(2) and EWA upstream releases to meet VAMP objectives and water quality control criteria should improve conditions for out-migrating juveniles and may provide passage for adults. However, NOAA Fisheries anticipates that despite the implementation of various protective measures a certain amount of incidental take, including injury and mortality, will occur. This anticipated incidental take is not expected to reduce overall population abundance and viability based on the effects, or apparent lack thereof, recent operations have had on CV steelhead population trend. Careful management of instream flows and temperatures in newly acquired spawning habitat, such as Clear Creek and the upper Sacramento River, should minimize the losses in upstream areas.

2. Spring-run Chinook Salmon.

Natural spawning populations of CV spring-run Chinook salmon are currently restricted to accessible reaches in the upper Sacramento River, Antelope Creek, Battle Creek, Beegum Creek, Big Chico Creek, Butte Creek, Clear Creek, Deer Creek, Feather River, Mill Creek, and Yuba River (DFG 1998, 2000, 2001). With the exception of Butte Creek and the Feather River, these populations are relatively small ranging from a few fish to several hundred. Butte Creek returns in 1998 and 1999 numbered approximately 20,259 and 3,679, respectively (DFG 2000). In 2000 and 2001 Butte Creek returns were 4,118 and 9,605 (DFG 2002 unpublished data). Also, Mill and Deer Creek returns generally increased since 1998 as shown by cohort replacement rates (CRR). However, the Butte Creek CRR actually declined in 2001 due to the unusually high number that returned in 1998.

Significant numbers of spring-run Chinook salmon, as identified by run timing, have returned to the FRH in recent years. However, CWT information from these hatchery returns indicates substantial introgression has occurred between fall-run and spring-run Chinook salmon populations in the Feather River due to hatchery practices (Sommer in DFG 2001). The number of adult spring-run Chinook salmon returning in 2000 and 2001 was below the 10 year average, but equal to the historical pre-dam average. It is unknown what proportion of wild fish make up the hatchery return since not all hatchery spring-run Chinook salmon have been marked.

In the mainstem Sacramento River and Feather River, the extent of spring-run Chinook salmon spawning is unknown, but is anticipated to be very low based on spawning surveys. Unlike conditions in the tributaries, mainstem spawning is subject to overlap and hybridization with fall-run Chinook salmon due to the limited habitat below dams. The Sacramento River mainstem has experienced the largest decline in spring-run abundance since the 1980s and has not rebounded. Cohort replacement rates in 2001 for the Sacramento and Feather River were 0.58 and 0.29, respectively, indicating a continued decline in abundance.

The average total count of spring-run Chinook salmon for 11 of the above-mentioned tributaries over the last five years, without the influence of the FRH, is 10,462 adults. The total count in 2001 was 13,326 adults (DFG 2002 unpublished data).

Although accurate population estimates for spring-run Chinook salmon within each basin are not available and the overall impact of CVP/SWP operations is difficult to quantify, NOAA Fisheries anticipates that the proposed project will not reduce the likelihood of survival and recovery of Central Valley steelhead for the following reasons: First, spring-run outmigration through the

Delta will occur during periods when protective measures for juvenile Chinook salmon, delta smelt and split-tail are implemented by the CVP/SWP Delta facilities to minimized losses associated with Delta operations. Second, flexibility in the day to day operations of each reservoir facility can be used to protect listed species at critical times, such as spawning, adult holding, and juvenile outmigration. These operations are monitored by the various work groups (e.g., B2IT, AROG) and will depend on precipitation patterns. The Bureau will use its discretion, in cooperation with these groups to conserve and protect salmonids and their habitat. An example of this would be increasing flows on the Sacramento River instead of on the American River to conserve cold water in Folsom for the summer and fall months and meet Delta water quality standards. Third, other protective measures for spring-run Chinook salmon implemented according to the CVPIA-AFRP objectives and (b)(2) Delta actions, EWA water transfers (Yuba and Feather River) and export curtailments, and the Sacramento River *Provisional Fall/Winter Juvenile Salmon Decision Process* are expected to minimize adverse Delta conditions and reduce the extent of losses that will occur in the action area. NOAA Fisheries anticipates that losses associated with CVP/SWP operations will still occur, but through careful management of take levels at the Delta fish facilities using surrogate releases and the above measures, these losses should be minimized. In addition, CRRs for tributaries containing small populations of spring-run Chinook salmon generally have shown upward trends despite the influence of mainstem and Delta effects due to CVP/SWP operations. NOAA Fisheries expects that straying from these small tributaries, especially Butte Creek which has undergone significant restoration improvement and recently has had adult spring-run Chinook salmon returns which likely exceed the creek's current carrying capacity, may help to replenish spring-run Chinook salmon populations in the Sacramento and Feather Rivers which currently have low CRRs.

K. Overall Impacts

Populations of CV spring-run Chinook salmon and CV steelhead are spatially spread out over 20 tributaries on the Sacramento River and San Joaquin River. Fish from many of these populations will only be affected by CVP/SWP operations as they migrate through the Delta. Current CVP/SWP operations already take actions (such as DCC gate closures, E/I ratio, Head of Old River Barrier, and export curtailments) to increase Delta survival during migration. The impact of individual actions is too small to be measured at the population level, but the overall impact seems to indicate a positive recovery trend given recent winter-run Chinook salmon adult escapement or spring-run Chinook salmon CRR data.

Below CVP and SWP reservoirs, flow conditions are predicted to provide adequate depths and velocities for spawning, rearing, and migration in the 50% exceedence forecasts. In the 90/75% exceedance forecasts low flows may decrease the spawning habitat availability of CV steelhead and predicted water temperatures are above the preferred range for steelhead egg incubation, juvenile rearing, and emigration in the American, Feather and Stanislaus rivers. However, recent studies on water temperatures in the Feather and American River indicate juvenile steelhead survive and grow well under these higher temperatures. For spring-run Chinook salmon the dry year forecast is anticipated to reduce spawning and reproductive success due to decreases in spawning habitat and high temperatures during September.

2. Biological Basis for NOAA Fisheries opinion

NOAA Fisheries uses four parameters to describe the viability of a salmonid population. These are: population abundance, growth rate, spatial structure, and diversity (McElhany 2000). The first four bullets below describe the current condition, based on available information, of the steelhead and spring-run Chinook salmon populations in the Central Valley by these parameters. Based on the available information, positive trends within the ESUs are promising indicators of potential future viability.

1. Population abundance: Juvenile estimates for steelhead and adult counts for spring-run Chinook salmon, where available, indicate stable or slightly increasing population trends (FWS 2001, FWS unpublished Chipps Island data, DFG 2002 unpublished data, and salvage data DWR 1992-2001). Adult steelhead counts, summarized from all know sources (Appendix 1), show a slight recovery since 1993 estimates, but recent counts are influenced by increased monitoring effort and Battle Creek supplementation.

2. Population Growth Rate: Cohort Replacement Rates for most spring-run Chinook salmon streams are increasing, except for the Sacramento and Feather River populations (DFG 1998). The Feather River CRR is based on hatchery stocks, which are not considered to be essential for the recovery of the species and are not listed at this time.

3. Population Spatial Structure: Habitat restoration projects (listed below) have increased critical upstream spawning and rearing habitat due to CVPIA mitigation for existing conditions.

   a) Dam removal on Clear Creek, added 8 miles of spawning habitat
   b) ACID improvements completed in 2001, opened 4 miles of spawning habitat on mainstem Sacramento River.
   c) Non-project streams (i.e. Mill, Battle, and Butte Creek) have undergone passage improvements and flow augmentation programs that have increased the recovery rate of CV steelhead and CV spring-run Chinook salmon.

4. Population Diversity: Existing protection measures (listed below) will reduce the loss of both species in the Delta and increase survival in upstream reaches by controlling temperatures, flows, gate closures and water quality.
   a) 1993 WR opinion (as amended in 1995)
   b) SWRCB-water rights D-1641
   c) *Juvenile Salmon Decision Process for Fall/Winter (October 1 - March 31)*

5. An analysis of the environmental baseline and effects of the proposed actions on relevant indicators using the guidelines for making Endangered Species Act determinations at the watershed level (NOAA Fisheries 1996), showed that most of the indicators (i.e. water quality, temperature, sediment, substrate, disturbance history) were maintained at a level that did not make conditions worse.

6. Decreases in the amount of agricultural pesticides and herbicides in the next two years are expected to provide water quality improvements in the Delta for listed salmonids.

7. Flexibility in CVP/SWP operations combined with coordination from various workgroups (i.e., AROG, B2IT, Stanislaus Fishery Group, Sacramento River Temperature Control) is anticipated to minimize impacts during critical life history stages (i.e., shutter timing on dams for temperature control, use of river outlets and spillways, power bypass using EWA credits from export reductions, and shifting releases from one river to another).

8. The use of CVPIA(b)(2) and CALFED EWA water to reduce exports in the Delta will improve Delta hydrodynamics and water quality, decrease mortality, and improve habitat conditions in upstream reaches by increasing flows and decreasing temperatures. Also, upstream releases of (b)(2) and EWA water at critical times, such as during spawning and outmigration periods, will provide insurance against low flow conditions in the 90% and 75% exceedence forecasts (dry years).

VI. CUMULATIVE EFFECTS

Cumulative effects include those effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Non-Federal actions that may affect the action area include State angling regulation changes, voluntary State or private sponsored habitat restoration activities, State hatchery practices, agricultural practices, water withdrawals/diversions, increased population growth, mining activities, and urbanization. Changes in State angling regulations generally are leading to greater restrictions on sport fishing that protect listed fish species. New regulations in 2002 will protect steelhead populations in the Calaveras River that were previously not considered to be steelhead. However, some angling regulations persist that allow the take of wild listed fish, such as on the upper Sacramento River.

Habitat restoration projects may have short-term harmful effects associated with in-water construction work, but these effects are temporary, localized, and the outcome is a benefit to these listed species. Hatchery practices may hasten the decline of naturally produced salmonids through genetic introgression, hybridization, competition, and disease transmission resulting from hatchery introductions. Farming activities within or adjacent to the action area may reduce foraging behavior, decrease growth rates, and increase susceptibility to disease for salmonids in the Sacramento River due to poor water quality from runoff laden with agricultural chemicals. Restrictions on the application of agricultural pesticides and herbicides are expected to increase in 2002-2004, which should decrease water quality impacts for listed fish species in the Delta.

Water withdrawals/diversions may result in entrainment of individuals into unscreened or improperly screened diversions, and may result in depleted river flows that are necessary for migration, spawning, rearing, flushing of sediment from spawning gravels, gravel recruitment and transport of large woody debris. Most of the largest diversions in the action area are screened or in planning phases with federal cost share money. The abundant smaller diversions (less than 40 cfs) are largely privately owned and may have a significant cumulative effect when considered together. On the American River the cumulative effect of water withdrawals outside of the watershed were found to have a significant effect on steelhead in the LAR by increasing summer time water temperatures. In addition, water temperatures would increase on the Sacramento River due to lower storage levels to compensate for the loss in flows on the American and the riparian habitat on the Feather River would also decrease (SWRI 2001).

Future urban development and mining operations in the action area may adversely affect water quality, riparian function, and stream productivity. Many of the intermittent streams important for steelhead spawning are being rapidly destroyed by urban sprawl before adequate monitoring can even detect presence and/or absence. Examples of this abound in the Roseville area north of Sacramento where very little coordinated watershed planning exists.

Future Federal, and State restoration actions are planned for Clear Creek, Mill Creek (i.e., Clough Dam removal), upper Sacramento River (i.e., FWS refuge riparian expansion and CVPIA spawning gravel injection), Stanislaus River, and in the Delta.

VII. CONCLUSION

The proposed operation of the CVP and SWP is likely to result in both adverse and beneficial impacts to spawning, rearing, and migration habitat for CV spring-run Chinook salmon and CV steelhead during the period between April 1, 2002, and March 31, 2004. These habitats are critical to the survival and recovery of the species, and consist of the water, the quality of that water, substrate, and adjacent riparian zone of accessible estuarine and riverine reaches.

Anticipated adverse impacts to critical habitat in upstream areas consist primarily of changes in the magnitude and duration of peak flow events below CVP and SWP reservoirs and elevated water temperature. High flow events during flood control operations may inundate stream-side gravel bars and benches. Flooding of these areas may result in stranding and isolation of juvenile salmonids, but can also provide juveniles access to emergent vegetation and productive near-shore habitat for foraging (i.e. Yolo Bypass studies, Sommers 2001). Low flow releases and flow fluctuation events during winter months may increase spawning mortality by dewatering redds and subjecting spawning fish to increased fishing pressure. Stabilization of flows and tapering of peak flood events may improve conditions for spawning and incubation through reduction of scouring events, flow fluctuations and water temperatures.

In the Delta, CVP and SWP export pumping alters Delta hydrodynamics by reducing total Delta outflows by as much as 14,000 cfs and altering net flows in several central and south Delta channels. These changes in Delta flow patterns can adversely affect the ability of adult steelhead and spring-run Chinook salmon to successfully home in on their natal CV streams. For juvenile fish, changes in Delta flow patterns result in some steelhead and spring-run Chinook salmon smolts being diverted from their primary rearing and migration corridors towards the CVP and SWP export pumps in the south Delta. The magnitude of impact to Delta flow and habitat conditions is dependent on a variety of factors including: 1) the level of exports in relation to the amount of incoming flows from the Sacramento River and the San Joaquin River, 2) the amount of agricultural returns into the system, and 3) tidal cycles. The AFRP (b)(2) and EWA Delta Fish Actions in coordination with the Fall/Winter Salmon Decision Process are expected to minimize decreased survival from reverse flow conditions through carefully timed periods of export curtailments when significant numbers of spring-run size yearlings are emigrating through the Delta into San Francisco Bay. It is anticipated that these Delta Fish Actions will also benefit CV steelhead smolts.

Other measures to protect and restore spring-run Chinook salmon habitat such as the Four Pumps Agreement Program, Tracy Direct Loss Mitigation, CVPIA-AFRP, and CALFED Ecosystem Restoration Plan will generally benefit steelhead as well. However, adequate habitat conditions must be maintained all year below project reservoirs for all life stages to benefit. The life history differences between steelhead and Chinook salmon may lead to conflicting flow requirements for each species. While steelhead need cold water for over summering below project dams, increased flows for Chinook salmon are typically scheduled for spring emigration and fall spawning.

The impacts described above are limited to the period of operation covered under this biological opinion (April 1, 2002 through March 31, 2004) and are not expected to result in significant impacts to or loss of spawning and rearing habitat for these species. The effects of the actions will impact every stage of the species life history except for ocean survival. However, the duration of these effects for the interim period are considered to be short-term single events whose effects can be overcome by changes in operations such as those the Bureau undertakes when recommended by the various advisory groups. Other impacts are expected to occur that may result in long-term impacts to spawning and rearing habitat. These additional impacts are primarily upstream and include the increased deposition of fine sediments in spawning gravels, decreased recruitment of spawning gravels, reduced transport of large woody debris, and encroachment of riparian and non-endemic vegetation into spawning and rearing areas resulting in reduced available habitat (NOAA Fisheries 1996). The cumulative effect of these additional long-term impacts would be reduced spawning and rearing habitat.

Recent studies on water temperature effects in the Feather and American rivers suggest that juvenile steelhead can sustain higher temperatures then previously reported in the literature. This has also been documented in the Southern California steelhead ESU, but to date no studies have been done on CV spring-run Chinook salmon. A greater impact however, is the effect of frequent flow fluctuations to meet the demand of water supply, water quality, and flood control.

It is anticipated that the resilient and opportunistic nature of the steelhead life history will decrease the significance of short-term effects from flow fluctuations or temperature changes. Steelhead and spring-run Chinook salmon respond favorably to wet year hydrology and could re-establish populations through straying or other means. To date, no policy on re-introductions has been developed by NOAA Fisheries in the Central Valley, but natural re-colonization has been well documented in the literature and could occur in newly opened areas such as Clear Creek or Battle Creek. Examples of this opportunistic trait exist in California, such as San Mateo Creek (San Diego Co.), which had not contained a steelhead run for 40 years due to extended drought and water withdrawal, and is now supporting a persistent population. In the Central Valley, the Calaveras River was recently found to contain four different life-history patterns for steelhead based on otolith work by DFG (Titus 2001, DFG memo). This suggests the importance of resident rainbow trout populations that may function as a genetic refuge for steelhead during dry years (McEwan 2001).

After reviewing the current status of threatened CV steelhead and CV spring-run Chinook salmon, the environmental baseline for the action area, the effects of the proposed operations for the CVP and SWP from April 1, 2002 through March 2004, and cumulative effects, it is the biological opinion of the NOAA Fisheries, that CVP and SWP operations from April 1, 2002 through March 2004, as proposed, are not likely to jeopardize the continued existence of CV steelhead or CV spring-run Chinook salmon.

Notwithstanding this conclusion, NOAA Fisheries anticipates that some actions associated with these operations may result in incidental take of the species. Therefore, an incidental take statement is provided with this biological opinion for these actions.

VIII. INCIDENTAL TAKE STATEMENT

Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. Harm is further defined to include significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and

7(o)(2), taking that is incidental to and not intended as part of the proposed action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with this Incidental Take Statement.

The measures described below are non-discretionary and must be implemented by Reclamation and DWR, for the exemption in section 7(o)(2) to apply. Reclamation and DWR have a continuing duty to regulate the activity covered in this incidental take statement. If Reclamation and/or DWR (1) fail to assume and implement the terms and conditions of the incidental take statement, and/or (2) fail to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, Reclamation and DWR must report the progress of the action and its impact on the species to NOAA Fisheries as specified in this incidental take statement (50 CFR 402.14(i)(3)).

This incidental take statement is applicable to all activities related to the operation of the CVP and SWP described in this opinion. Unless modified, this incidental take statement does not cover activities that are not described and assessed within this opinion. In addition, unless modified, this incidental take statement does not cover the facilities or activities of any CVP or SWP contractor, or the facilities or activities of parties to agreements with the U.S. that recognize a previous vested water right.

A. Amount or Extent of Take

NOAA Fisheries anticipates that threatened CV steelhead and CV spring-run Chinook salmon will be taken as a result of this proposed action. The incidental take is expected to be in the form of death, injury, harm, capture, and collection. Death, injury, and harm to juvenile and adult steelhead and spring-run Chinook salmon are anticipated from the depletion and storage of natural flows at CVP and SWP reservoirs. Reservoir operations are expected to significantly alter the natural hydrological cycle in the Sacramento River downstream of Shasta Dam, Clear Creek downstream of Whiskeytown Dam, the Feather River downstream of Oroville Dam, the American River downstream of Folsom Dam, and the Stanislaus River downstream of New Melones Dam.

Reservoir releases to downstream areas during flood control operations may result in the take of steelhead eggs and pre-emergent fry through the scouring of redds. The potential amount and extent of take of steelhead eggs and pre-emergent fry is difficult to predict, because it is directly dependent on precipitation patterns during the upcoming winter and spring months. Heavy rainfall is likely to trigger flood control operations at Central Valley reservoirs and result in short-term high flow events in the upper Sacramento River, Clear Creek, Feather River, American River and/or Stanislaus River. Extremely high flow events may scour steelhead redds and result in the injury and mortality of steelhead eggs and sac-fry. Incidental take of steelhead due to flood control operations will be difficult to detect, because any dead or injured fish will be within the gravel substrate of the streambed.

Flood control operations can also lead to the incidental take of fry and juvenile steelhead and spring-run Chinook salmon through stranding and isolation. Isolation may occur in areas that are not connected to the river or creek except during periods of high flows. Heavy rainfall is likely to trigger flood control operations at Central Valley reservoirs and result in short-term high flow events in the upper Sacramento River, Clear Creek, Feather River, American River and/or Stanislaus River. During periods of high flows, juvenile steelhead and spring-run Chinook salmon may enter into areas that become isolated when flows recede. If additional high flow events do not follow within a short period of time, these isolated fish may be lost to predation, lethal water temperature conditions, or desiccation. Incidental take of fry and juvenile steelhead is anticipated if precipitation patterns result in flood control operations. However, the extent of isolation will be difficult to detect and quantify due to the large geographic area that will be affected and because finding a dead or injured specimen is unlikely without a systematic survey immediately following the flood event. Take of adult steelhead is unlikely to occur as a result of flood control operations and no take of adult spring-run Chinook salmon is anticipated.

Delays to adult spring-run Chinook salmon occur when RBDD gates are in the closed position between May 15 and July 30. Average delays of 11 days (range from 1- 40 days) have been reported by radio-tagging experiments on spring-run Chinook salmon (FWS 1990). These delays may increase the chance that adult spawners will be unable to access some tributary streams above RBDD, due to low flows and thermal barriers developing at the tributary mouth. The potential amount of this take is difficult to predict, but it is assumed that spring-run Chinook salmon that cannot access their natal stream of origin would either die without spawning or continue up the mainstem Sacramento River to spawn shortly before or with fall-run Chinook salmon.

Dry conditions or moderate precipitation will create low instream flows below SWP and CVP controlled reservoirs. Such conditions could result in take of steelhead eggs and pre-emergent fry through dewatering of redds and take of over-summering juvenile steelhead through high water temperatures. In the 90% exceedence forecast, water temperatures would reach lethal limits for juvenile steelhead in the Feather River low flow channel from June through August and in the American River from April through October. In the 50% exceedence forecast water temperatures are in the preferred range for steelhead and spring-run Chinook salmon for a portion of the streams directly below the dams: Sacramento River from Keswick Dam to Red Bluff, American River from Nimbus Dam to Watt Avenue, Feather River from Oroville Dam to the Thermalito Afterbay, Stanislaus River from Tulloch Dam to Oakdale and Clear Creek from Whiskeytown Dam to the Powerline Crossing Road (RM 5). Water temperatures above the preferred ranges for these two species will limit the available habitat in the above described reaches for juvenile over-summer rearing and emigration. Low flow conditions forecasted for dry conditions (90% exceedence forecast) or below normal precipitation can lead to rapid decreases in stream flows during critical spawning periods (i.e., as occurred on the American River in February 2001 [see

CALFED Fish Action #3]), which may dewater steelhead redds or stress adults through repeated capture on the redds by anglers. Low flow conditions can also prevent spring-run Chinook adults from reaching their spawning areas by creating thermal barriers at the stream mouth and subjecting the adults to increased poaching or predation in summer holding pools (e.g., Clear Creek).

Capture and collection of juvenile steelhead in the Stanislaus River by screw traps is anticipated through fisheries studies to evaluate New Melones Reservoir operations on anadromous salmonids. Based on past sampling by screw trap at the Oakdale sampling site, up to 60 steelhead smolts and pre-smolts may be captured and released below the trapping site. Steelhead fry have not been captured in previous years and none are expected to be captured in 2002-2004. Previous sampling experience with screw traps in the Stanislaus River indicates that all captured steelhead will be maintained in good physical condition and released unharmed back into the river.

A resistance board weir funded by CALFED is scheduled for installation in 2002 on the Stanislaus River (SPCA 2002). In order to meet it's monitoring goals the weir will subject migrating adult steelhead to temporary delays, confinement, and stress from handing and tissue sampling. However, based on similar weirs in Alaska and Northern California adult mortality is expected to be less than five percent and no juvenile mortality is expected. Therefore, assuming that 100 adult steelhead will pass through the weir based on the low number of adults caught by anglers and observed in snorkel surveys, is anticipated that adult mortality will be less than five fish.

Harmful effects from trapping adult steelhead will be minimized by: (1) conducting daily snorkel surveys above and below the weir to identify any migrational delays, (2) coordinating with NOAA Fisheries and the steering committee regarding any problem resolution, (3) ensuring that the confinement structure will not abrade scales or fins, and (4) frequent monitoring of the confinement area to avoid stress. In addition, at least one trained and qualified fisheries technician (minimum 2 years experience with sampling and handling anadromous salmonids) will be onsite during each day of sampling. From previous sampling experience with this type of weir, the expected capture and release of no more than 100 adult steelhead is expected to have little, if any effect, on the Stanislaus River population due to adherence to sampling/handling protocols that minimize stress and harm.

Capture and collection of juvenile steelhead and spring-run Chinook salmon in the Feather River by rotary screw traps, fyke traps, and seines is anticipated through fisheries studies to evaluate the effect of flow fluctuations. Based on past monitoring by screw traps in the low flow channel and seining below the Thermolito outlet, fewer than 600 juvenile steelhead/rainbow trout; 3,000 spring-run YOY; and 10 spring-run Chinook salmon yearlings; are expected be captured and released below the trapping site (DWR 2002). It is not expected that steelhead or spring-run Chinook salmon fry will be captured, due to timing of emergence occurring before the start of the sampling period. Capture and collection of adult steelhead and spring-run Chinook salmon may also occur during sampling. Based on previous sampling no adult spring-run Chinook salmon and fewer than 25 adult steelhead are expected to be captured and released. Experience with trapping and seining in the Feather River indicates that all captured steelhead will be maintained in good physical condition and released unharmed back into the river.

In the Delta, death, injury, and harm to juvenile and adult steelhead and spring-run Chinook salmon are anticipated due to unnatural flow patterns created by the operation of the Delta Cross Channel and CVP/SWP export pumping. This take includes that incurred by salvage activities, predation associated with physical structures, losses due to entrainment at water diversions, elevated water temperatures, poor water quality, reverse flow conditions and straying of adult upstream migrants. Additional take of juvenile steelhead and spring-run Chinook salmon is expected at the Rock Slough intake at the Contra Costa Canal. Incidental take through the capture and collection of juvenile and adult steelhead, and juvenile spring-run Chinook salmon at the Tracy and Skinner Fish Facilities is anticipated. At the Suisun Marsh Salinity Control Structure delays in fish passage from tidal operations and collection of adults in fisheries studies to evaluate passage are expected.

CWT late fall-run Chinook salmon from the Coleman National Fish Hatchery will serve as a surrogate for losses of CV spring-run Chinook yearlings, because juvenile spring-run Chinook salmon may not be distinguishable from other Central Valley Chinook races in the Delta, and there is no juvenile production estimate available for CV spring-run Chinook salmon. These late fall-run Chinook salmon should serve as an appropriate surrogate for spring-run Chinook salmón losses because NOAA Fisheries expects that these fish, which begin their emigration and smoltification passage through the Delta at approximately the same time and size as wild spring-run Chinook salmon, and will be taken at the same rate as wild spring-run Chinook salmon. Therefore conditions which result in the loss of one percent of the late fall-run Chinook salmon are likely to have resulted in the loss of one percent of the spring-run Chinook salmon population.

Operations of the Delta Cross Channel gates and export pumping plants are expected to cause mortality in the central Delta. In most years these losses will be minimized by intermittent gate closures from October through January and mandatory closures from February 1 to May 20 (SWRCB, D-1641). However, the survival of spring-run Chinook salmon and steelhead juveniles that are diverted into the central Delta will be reduced by high rates of predation, elevated temperatures, unscreened diversions, poor water quality, reverse flow conditions, and entrainment at the Delta pumping facilities. Losses can be quantified at the Tracy and Skinner fish facilities based on observations of salvaged fish, but the remaining mortality can not be easily quantified, because dead or injured juvenile fish (e.g., as a result of altered flow patterns and the resulting exposure to degraded habitat conditions in the central Delta) are not likely to be detected. These mortalities of juvenile spring-run Chinook salmon and steelhead in the Delta are generally attributed to increased residence time, length of migration route, reverse flows, altered salinity gradient, predation, elevated water temperatures, contaminants, and reduced food supply (DFG 1998; McEwan 2001).

Although most losses in the Delta cannot be quantified, some losses of spring-run Chinook salmon yearlings and steelhead smolts will be monitored at the Tracy and Skinner fish facilities. Based on adherence to the CALFED Operations, Fall/Winter Salmon Decision Process, it is anticipated that the incidental take of juvenile spring-run Chinook salmon will not exceed one percent of the Central Valley population. Take of YOY spring-run Chinook salmon is expected in the Delta between December and May. Juvenile spring-run Chinook salmon arriving in the Delta as sub-yearlings will be subject to mortality within the Delta and at the pumps as mentioned previously. Due to their overlap in size with fall-run Chinook salmon, losses of YOY spring-run Chinook salmon are not easily quantified or monitored through observations of salvaged fish. However, a mixed stock analysis using combined fall-run and spring-run Chinook salmon YOY losses at the facilities from 1994-1998, showed spring run fish represented less than one percent of the total loss, whereas Sacramento River fall-run fish accounted for 7.4 percent and San Joaquin River fall-run fish made up the majority at 92.5 percent (DWR 1999). The total combined YOY loss from 1994 to 1998 ranged from 11,258 to 124,816, with an average loss of 74,087 per year. This average is the anticipated total combined loss of YOY spring- and fall-run Chinook salmon from the proposed project operations, and the anticipated take of YOY spring-run chinook salmon is calculated to be 741 individuals per year.

Although loss estimates for steelhead at the Tracy and Skinner Fish Facilities have never been determined, the level of take for steelhead can be anticipated from salvage estimates in prior years. Based on salvage data from 1993-2000, the number of unclipped juvenile steelhead salvaged from both facilities has ranged from 300 to 18,000 (average = 4,200) fish during the season (December and June). Therefore, the number of unmarked steelhead salvaged (note: these fish are returned alive to the Delta by trucking to release sites) during the proposed Project is expected to be less than 4,500 individuals per year. At Rock Slough, based on recent monitoring since 1996, fewer than 15 juvenile steelhead and 50 juvenile spring-run Chinook salmon per year, are expected to be killed through entrainment in the Contra Costa Canal.

Reclamation and DWR have proposed to operate CVP and SWP facilities in accordance with either plans, agreements, or specific criteria outlined in this biological opinion. Deviations from these plans, agreements, or criteria may result in adverse impacts to CV spring-run Chinook salmon and steelhead that have not been analyzed in this opinion. In this event, formal consultation shall be reinitiated immediately to analyze the effects to spring-run Chinook salmon and steelhead and determine if the changes are likely to jeopardize these species or result in additional incidental take.

B. Effect of the Take

The effect of this action in the up river areas will consist of fish behavior modification, temporary loss of habitat value, and potential death or injury of egg, fry and juvenile steelhead and spring-run Chinook salmon resulting from flow fluctuations in the upper Sacramento River, Clear Creek, Feather River, American River, and Stanislaus River. In the Delta, this action will alter fish behavior, result in modification of habitat value, and result in the death and injury of juvenile and adult fish as a result of altered Delta flow patterns and direct loss at the Tracy and Skinner fish collection facilities.

In the accompanying biological opinion, NOAA Fisheries determined that this level of anticipated take is not likely to result in jeopardy to the continued existence of CV steelhead or CV spring-run Chinook salmon.

C. Reasonable and Prudent Measures

NOAA Fisheries believes the following reasonable and prudent measures are necessary and appropriate to minimize take of CV steelhead and CV spring-run Chinook salmon:

1. Reclamation and DWR shall minimize the adverse effects of flow fluctuations associated with upstream reservoir operations on the incubating eggs, fry, and juvenile steelhead and spring-run Chinook salmon.

2. Reclamation and DWR shall gather information regarding the effects of flow fluctuations on spring-run Chinook salmon and steelhead downstream of CVP and SWP reservoirs, develop long-term ramping criteria, and operate to the extent possible to meet temperature objectives that will avoid or minimize adverse effects.

3. Reclamation and DWR shall operate to temperature objectives to the extent possible below project Dams that will avoid or minimize adverse effects to spring-run Chinook salmon and steelhead.

4. Reclamation shall minimize the adverse effects of Delta Cross Channel gate operations on juvenile steelhead and spring-run Chinook salmon.

5. Reclamation and DWR shall minimize the adverse effects of Delta exports on juvenile steelhead and spring-run Chinook salmon.

6. Reclamation and DWR shall collect additional data at the fish salvage collection facilities for improving facility operations and incidental take monitoring with regard to steelhead and spring-run Chinook salmon.

7. Reclamation in coordination with DWR shall submit weekly (DAT) reports and annual written reports to NOAA Fisheries regarding the results of monitoring and incidental take of spring-run Chinook salmon and steelhead associated with operations of project facilities (50 CFR 402.14[I][3]).

D. Terms and Conditions

Reclamation and DWR must comply or ensure compliance by their contractor(s) with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

1. Reclamation and DWR shall minimize the adverse effects of flow fluctuations associated with upstream reservoir operations on the incubating eggs, fry, and juvenile steelhead and spring-run Chinook salmon.

a. Reclamation and DWR shall coordinate with NOAA Fisheries before reducing releases downstream of Keswick Dam, Whiskeytown Dam, Nimbus Dam, Oroville Dam, and/or Goodwin Dam to a monthly average flow less than the levels identified in the CVPIA(b)(2) forecast or the AFRP revised flow matrix.

b. Clear Creek - Reclamation shall assist in developing a Fisheries Management Plan (FMP) in coordination with DFG, FWS and NOAA Fisheries that will balance upstream flow and temperature requirements of spring-run Chinook salmon, steelhead and fall-run Chinook salmon with the impact of operations on other CVP objectives, including water supply, power, and temperature control for winter-run Chinook salmon.

c. Feather River - During periods outside of flood control operations and to the extent controllable during flood control operations, DWR shall ramp down releases to the low flow channel as presented in the table below:

Feather River Low-Flow Channel Releases (cfs)	Rate of Decrease (cfs)
5,000 to 3,501	1,000 per 24 hours
3,500 to 2,501	500 per 24 hours
2,500 to 600	200 per 24 hours

d. American River - During periods outside of flood control operations and to the extent controllable during flood control operations, Reclamation shall ramp down releases in the American River below Nimbus Dam as presented in the tables below, From January 1 through March 31, Reclamation must insure fisheries monitoring is conducted during ramp down of stream flows below 1500 cfs to minimize dewatering of steelhead redds or adverse effects to incubating eggs. During any 24-hour period, Reclamation must not decrease the river release from Nimbus more than the range in each row of the table. To the extent possible, Reclamation must make at least three separate equal release changes during each

24-hour period and separate the changes by equal time periods. Below 5,000 cfs, Reclamation must not reduce more than 500 cfs during any 24-hour period, or decrease flows more than 50 cfs per hour. For reductions below 1,500 cfs, Reclamation must coordinate with NOAA Fisheries (or DFG and/or FWS if NOAA Fisheries is not available).

Lower American River Daily Rate of Change (cfs)	Amount of Decrease in 24 hrs (cfs)
20,000 to 16,000	4,000
16,000 to 13,000	3,000
13,000 to 11,000	2,000
11,000 to 9,500	1,500
9,500 to 8,300	1,200
8,300 to 7,300	1,000
7,300 to 6,400	900
6,400 to 5,650	750
5,650 to 5,000	650

The following table gives the individual desired flow rates for the lower American River (3 changes per day) in more detail.

Initial Flow 20,000 (cfs)	First Flow Change (cfs)	Second Flow Change (cfs)	Third Flow Change (cfs)
Day 1	18,650	17,300	16,000
Day 2	15,000	14,000	13,000
Day 3	12,300	11,600	11,000
Day 4	10,500	10,000	9,500
Day 5	9,100	8,700	8,300
Day 6	7,950	7,600	7,300
Day 7	7,000	6,700	6,400
Day 8	6,150	5,900	5,650
Day 9	5,400	5,200	5,000

e. Stanislaus River - During periods outside of flood control operations and to the extent controllable during flood control operations, Reclamation shall ramp down releases in the Stanislaus River below Goodwin Dam as presented in the table below:

Existing Release Level (cfs)	Rate of Increase (cfs)	Rate of Decrease (cfs)
at or above 4,500	500 per 4 hours	500 per 4 hours
2,000 to 4,499	500 per 2 hours	500 per 4 hours
500 to 1,999	250 per 2 hours	200 per 4 hours
300 to 499	100 per 2 hours	100 per 4 hours
150 to 299	75 per 2 hours	50 per 4 hours

2. Reclamation and DWR shall gather information regarding the effects of flow fluctuations on spring-run Chinook salmon and steelhead downstream of CVP and SWP reservoirs, develop long-term ramping criteria, and operate to temperature objectives that will avoid or minimize adverse effects.

a. Reclamation and DWR shall participate in the design and implementation of a monitoring program for CV steelhead and CV spring-run Chinook salmon that will include adult and juvenile direct counts, redd surveys, and escapement estimates on CVP and SWP controlled streams during 2002 through 2004. The program shall include identification and evaluation of steelhead and spring-run Chinook salmon rearing and spawning habitat along with areas of potential stranding and isolation. This information shall serve as a basis for establishing long-term ramping rate criteria and temperature compliance points. The monitoring proposal and schedule for implementation must be submitted to NOAA Fisheries for review and approval by November 30, 2002. If appropriate, authorization for any incidental take associated with the implementation of these monitoring programs will be provided to Reclamation, DWR, or their agent, after NOAA Fisheries review and approval of the study plans.

b. All monitoring programs that involve the intentional taking of spring-run Chinook salmon or steelhead must be conducted by a person or entity that has been authorized by NOAA Fisheries. Reclamation will establish a contact person for these activities.

c. Stanislaus River - Reclamation shall provide an annual report regarding results of the 2002-2004 fisheries monitoring studies to NOAA Fisheries (Southwest Region, -Protected Resources Division, Sacramento Area Office, 650 Capitol Mall, Suite 8-300, Sacramento, California 95814) by September 30 each year. The report shall include: (1) the number of steelhead captured; (2) fork length; (3) condition (e.g., alive, injured, dead, and life stage characterization); (4) number of steelhead released back into the river; and (5) other information collected (e.g., water velocity, temperature, and turbidity measurements). Life stage characterization guidelines are available in the Steelhead Life-Stage Assessment Protocol developed by the Interagency Ecological Program Steelhead Project Work Team (December 1998).

d At least one trained and qualified fisheries technician (i.e., minimum of 2 years experience with sampling and handling of juvenile anadromous salmonids) shall be onsite during each day of sampling throughout the duration of the fisheries monitoring program to insure full adherence to the sampling and handling protocols identified in the Stanislaus River Sampling Plan submitted by Reclamation to NOAA Fisheries on May 14, 1999.

e. Incidental take of juvenile steelhead in the Stanislaus River by rotary screw traps may not exceed 60 steelhead smolts in one sampling season.

f. Incidental take associated the CALFED funded resistance board weir for adult Chinook salmon escapement may not exceed 100 adult steelhead (with 5% mortality) and 50 tissue samples (scales, fin clips or DNA) for the year.

g. Feather River - DWR shall provide a written report containing the results of rotary screw traps, fyke traps, snorkel surveys, creel census and tissue sampling for 1999 through 2002 monitoring studies to NOAA Fisheries (Southwest Region, Protected Resources Division, Sacramento Area Office, 650 Capitol Mall, Suite 8-300, Sacramento, California 95814-4706). In addition, DWR will continue with the stranding and isolation study as proposed in its August 7, 2000 report to NOAA Fisheries. Additional studies are needed to determine (1) in-river abundance, (2) spawning habitat utilization, and (3) suitability of current flow pattern (600 cfs) for all life-stages of steelhead and spring-run Chinook salmon. Incidental take associated with Feather River monitoring studies may not exceed the following:

steelhead juveniles : 600
steelhead adults: 25
spring-run size Chinook salmon (YOY): 3,000
spring-run size Chinook salmon (juveniles): 10

spring-run size Chinook salmon (juveniles): 10

h. At least one trained and qualified Fisheries technician (i.e., minimum of 2 years experience with sampling and handling of juvenile anadromous salmonids) shall be onsite during each day of sampling throughout the duration of the Fisheries monitoring program to insure full adherence to the sampling and handling protocols identified in the Stranding and Redd De-watering Study Plan submitted by DWR on August 7, 2000.

3. Reclamation and DWR shall operate to temperature objectives, to the extent possible, below project dams that will avoid or minimize adverse effects to spring-run Chinook salmon and steelhead. Reclamation shall work with the Sacramento River Temperature Task Group and the American River Workgroup to ensure compliance with other obligations of the projects. NOAA Fisheries will not consider reinitiating of consultation necessary if the temperature objective is exceeded by 0.5°F or less provided the Bureau or DWR has promptly implemented measures to reduce the temperature to the objective and the exceedence lasts no more than 3 days. Reclamation and DWR must provide written notification to NOAA Fisheries after 3 days of temperature exceedence.

a. Clear Creek - In the absence of a FMP, Reclamation shall to the extent possible, control water temperatures by flow releases from Whiskeytown Dam to the Igo gage between June 1 through September 15, to a daily average temperature of 60°F, to protect over-summering juvenile steelhead from thermal stress and from warm water predators. In addition, from September 15 through October 30, Reclamation shall reduce water temperatures to 56°F to protect spring-run Chinook salmon spawning and egg incubation.

b. American River - Reclamation shall, to the extent possible, control water temperatures in the lower river between Nimbus Dam and the Watt Avenue Bridge (RM 9.4) from June 1 through November 30, to a daily average temperature of less than or equal to 65°F to protect rearing juvenile steelhead from thermal stress and from warm water predator species. The use of the cold water pool in Folsom Reservoir should be reserved for August through October releases.

c. Stanislaus River - Reclamation shall, to the extent possible, control water temperatures by flow releases to the lower river between Goodwin Dam (RM 58.5) and Orange Blossum Road bridge (USGS gage) during June 1 through November 30, to a daily average temperature of less than or equal to 65°F to protect over-summering steelhead from thermal stress and from warm water predator species. If temperature releases are required, Reclamation must coordinate with DFG and FWS to use fishery release water consistent with NMIPO, D-1641, and CVPIA.

61.6 (Robinsons Riffle) from June 1 through September 30 to a daily average temperature of less than or equal to 65°F to protect over-summering steelhead from thermal stress and from warm water predator species. This term is not intended to preclude pump-back operations at the Oroville Complex that are needed to assist the State of California with supplying energy during periods when the California ISO has anticipated Stage 2 or higher alerts.

4 Reclamation shall minimize the adverse effects of DCC gate operations on juvenile steelhead and spring-run Chinook salmon.

a. During the period from April 1, 2002 through March 31, 2004, Reclamation shall operate the gates of the DCC consistent with the CALFED OPS, Water Quality Control Plan D-1641 and the *Provisional Fall/Winter Juvenile Salmon Decision Process (October 1-March 31)*. Reclamation and NOAA Fisheries, in coordination with the CALFED, Data Assessment Team (DAT) will monitor water quality conditions within the Delta. Gate openings for water quality improvements shall be coordinated with NOAA Fisheries (Sacramento Area Office), DFG, and FWS and openings shall be minimized if Fisheries monitoring results indicate juvenile Chinook salmon and steelhead are emigrating in the vicinity of the DCC.

b. To address the potential competing objectives of water quality improvement and fisheries protection, Reclamation and DWR shall develop specific water quality criteria, operational rules, and decision making process for operation of the DCC gates during the period between October 1 and March 31. This effort shall include investigation of whether hydrodynamic models can be used to predict potential water quality problems and alternative operations scenarios for the DCC gates and the Delta export pumps. Updated water quality criteria, operational rules, and the decision-making process shall be provided to NOAA Fisheries for review and concurrence as revisions occur.

5. Reclamation and DWR shall minimize the adverse effects of Delta exports on juvenile steelhead and spring-run Chinook salmon.

a. Based on observations of juvenile steelhead, juvenile spring-run size Chinook salmon (70 mm to 150 mm), or late-fall Chinook salmon surrogates (CWT fish from Coleman National Fish Hatchery) in: (1) lower Sacramento River Fisheries monitoring stations (Knights Landing, Sacramento Trawl, beach seine program); (2) Delta Fisheries monitoring stations (beach seine program, Chipps Island); or (3) Tracy or Skinner fish salvage facilities; Reclamation and DWR shall reduce CVP and SWP pumping levels to improve the survival of steelhead and spring-run Chinook smolts in the Delta for periods extending from 5 to10 days. These export reductions to a combined CVP/SWP pumping rate of 4,000 to10,000 cfs, depending on Delta inflow conditions, will be implemented based on the protocol and water quality criteria established in the *Provisional Fall/Winter Juvenile Salmon Decision Process (October 1- March 31)* and initiated by NOAA Fisheries. The decision to implement these export curtailments, their duration, and specific export level will be made by Reclamation and DWR. This decision will be based on discussions within the WOMT after receiving recommendations from the DAT. NOAA Fisheries will provide Reclamation and DWR, at minimum, 72 hours notice prior to the initiation of the target CVP/SWP export rates. NOAA Fisheries will make every effort possible to ensure that recommendations combine these export curtailments with the currently proposed (b)(2) actions FWS. Curtailments pursuant to this term and condition are not constrained by the Department of Interior's (b)(2) water budget.

b. Incidental take of yearling spring-run Chinook salmon at the CVP and SWP Delta export facilities will be based on observations of CWT late-fall Chinook salmon uniquely marked at Coleman National Fish Hatchery and released in the upper Sacramento Basin. Loss at the CVP and SWP Delta export facilities may not exceed one percent of any individual release group of CWT late fall Chinook surrogates released in the upper Sacramento Basin from April 1, 2002, through March 31, 2004. Take will be calculated with the standard loss estimation procedures applicable at the respective fish collection facilities. At the one percent cumulative loss level, Reclamation and DWR must take actions to avoid further loss and reinitiate consultation.

c. Incidental take of YOY spring-run Chinook salmon from December to May shall determined using mixed stock analysis of CWT recoveries at the Delta Fish Facilities and applied to the adult escapement estimates for each drainage. Therefore, the estimated YOY spring-run Chinook salmon loss may not exceed one percent of the total YOY Chinook salmon loss at the Delta Fish Facilities in any one year.

d. Incidental take of steelhead at the CVP and SWP Delta export facilities will be based on seasonal yearly observations of unmarked steelhead at the Tracy and Skinner fish collection facilities from October through September. Combined cumulative salvage of all unmarked steelhead at the CVP and SWP export facilities may not exceed 4,500 fish during this period, based on the salvage estimation procedures described in the 4-Pumps Agreement at the respective collection facilities. If cumulative salvage of unmarked steelhead reaches 4,500 fish for the water year (October through September), Reclamation and DWR must take actions to avoid further collection and salvage of steelhead and reinitiate consultation.

e. Incidental take for the Rock Slough Old River Intake will be based on current DFG monitoring until a fully screened intake is built. Loss of juvenile spring-run

e. Incidental take for the Rock Slough Old River Intake will be based on current DFG monitoring until a fully screened intake is built. Loss of juvenile spring-run Chinook salmon and steelhead shall be combined with Tracy and Banks fish facilities and reported in an annual monitoring report (see 6 [d]).

f. Incidental take for the Suisun Marsh Salinity Control Gates shall be based upon DFG monitoring studies associated with gate operations. It is anticipated that some adult steelhead may be caught during these studies, therefore up to 10 adult steelhead may be tagged to determine their migratory patterns.

6. Reclamation and DWR shall collect additional data at the fish salvage collection facilities for improving facility operations and incidental take monitoring with regard to steelhead and spring-run Chinook salmon.

a. DNA tissue samples and CWT samples from juvenile spring-run Chinook salmon and steelhead at the Tracy and Skinner fish collection facilities shall be collected by DWR or DFG for genetic analysis or tag removal/reading pursuant to the sampling protocols established by the IEP Salmon Genetics Project Work Team. Tissues shall be stored at the DFG tissue bank at Rancho Cordova for subsequent analysis by Oregon State University or similar lab approved by NOAA Fisheries. Whole fish or heads for CWT processing/identification shall be stored at the FWS Bay/Delta Office in Stockton. All samples shall be clearly marked according to office protocol and a log maintained at each storage facility. Unclipped steelhead samples for DFG otolith studies may be collected and stored at the above facilities after providing NOAA Fisheries, Sacramento Office with a detailed study plan.

b. For the period from October 1 through June 30, Reclamation and DWR must calculate a daily loss estimate for juvenile steelhead through the Tracy and Skinner Fish Facilities, which includes predation through Clifton Court (i.e., prescreen loss), louver efficiencies, and trucking and handling loss, on a real-time basis similar to how Chinook salmon loss is calculated.

c. Reclamation and DWR must use personnel for monitoring at the fish salvage facilities that are experienced in the sampling and handling of juvenile anadromous salmonids. This experience should include instruction in at least one course in juvenile fish identification that includes both salmon and steelhead.

7. Reclamation in coordination with DWR shall submit weekly (DAT) reports and annual written reports to NOAA Fisheries regarding the results of monitoring and incidental take of spring-run Chinook salmon and steelhead associated with operations of project facilities (50 CFR 402.14[I][3]).

a. Reclamation in coordination with DWR shall provide a written annual data report to be submitted by September 30 of each year. This report shall summarize the results of CV spring-run Chinook salmon and CV steelhead monitoring and incidental take associated with the operation of the Delta Fish Facilities (including the Rock Slough Pumping Plant). All juvenile mortality must be minimized and reported, including those from special studies conducted during salvage operations. This report should be sent to NOAA Fisheries (Southwest Region, Protected Resources Division, Sacramento Area Office, 650 Capitol Mall, Suite 8-300, Sacramento, California 95814-4706).

IX. CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. These "conservation recommendations" include discretionary measures that Reclamation and DWR can take to minimize or avoid adverse effects of a proposed action on a listed species or critical habitat or regarding the development of information. In addition to the terms and conditions of the Incidental Take Statement, the NOAA Fisheries provides the following conservation recommendations that would reduce or avoid adverse impacts on the listed species:

1. Reclamation and DWR should support and expand anadromous salmonid monitoringprograms throughout the Central Valley to improve understanding of the life history of these listed species and improve the ability to provide Fisheries protection through real-time management of CVP/SWP facilities.

2. Reclamation and DWR should participate in watershed planning efforts, and support measures to protect adequate instream flows, and equitable approaches to increasing stream flows and water available for flow augmentation.

3. Reclamation and DWR should support and promote aquatic and riparian habitat restoration downstream of CVP/SWP reservoirs with special emphasis upon the protection and restoration of shaded riverine aquatic cover and increase the existing stream meander zone.

4. Reclamation and DWR should continue to provide benefits to spring-run Chinook salmon and steelhead to mitigate losses associated with CVP/SWP Delta Facilities on spring-run Chinook salmon and steelhead.

   a. DWR shall continue to implement and/or fund projects pursuant to the 4-Pumps Agreement, including the four projects listed herein (Durham Mutual/Parrott-Phelan screens and ladders, Mill Creek water exchange, Deer Creek water exchange, and warden overtime).

   b. Reclamation and DWR shall work with NOAA Fisheries, FWS and DFG to implement and/or fund any other projects that are deemed necessary and appropriate to provide for the protection and/or recovery of CV spring-run Chinook salmon or steelhead.

5. Reclamation and DWR shall work with NOAA Fisheries, FWS and DFG to implement and fund any monitoring associated with projects that Reclamation, DWR, DFG, FWS or NOAA Fisheries agree are necessary and appropriate to determine incidental take levels or provide for the protection and/or recovery of CV spring-run Chinook salmon or steelhead.

6. An adaptive management approach, including monitoring of salmon and steelhead status and response to flow fluctuations, if they occur, should be established for each river to minimize the loss associated with isolation and stranding events. If inadequate water resources are anticipated, Reclamation and DWR should expedite the purchase of water from willing sellers through EWA or (b)(3) to ensure meeting their environmental responsibilities.

7. Pursue opportunities to conserve water and manage water more effectively, including but not limited to: improving water measurement, accurate water accounting, minimizing conveyance losses, and minimizing environmental impacts to instream resources.

8. Reclamation should maintain a target carryover storage in Folsom Reservoir of 600 TAF during Wet Years with a minimum end -of -September storage in Dry Years of 450 TAF, in order to conserve cold water for use during the summer and provide suitable spawning flows in the fall and winter.

X. REINITIATION OF CONSULTATION

This concludes formal consultation on the actions outlined in the biological opinion for the proposed operation of the CVP and SWP from April 1, 2002, through March 31, 2004. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered in this opinion; (3) the action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, formal consultation shall be reinitiated immediately.

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LIST OF ACRONYMS

(b)(1)	Section 3406 of the CVPIA pertaining to re-operation of the CVP
(b)(2)	Section 3406 of the CVPIA pertaining to use of 800 TAF of CVP water
(b)(3)	Section 3406 of the CVPIA authorizing environmental water acquisitions
95-1WR	SWRCB 1995 Water Quality Control Plan for the Delta
ACID	Anderson-Cottonwood Irrigation District
AFRP	Anadromous Fish Restoration Program
AROG	American River Workgroup
Article 21 water	interruptible supplies to SWP contractors
BA	Biological Assessment
B2IT	(b)(2) Interagency Team
BPP	SWP Harvey O. Banks Delta Pumping Plant
CALFED	Governor's water policy council (vice Club Fed)
CALFED-OPS	CALFED Operations Group
CALSIM II	CVP/SWP operations model
CCF	Clifton Court Forebay
CCWD	Contra Costa Water District
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
C-HI	Critical year with High Initial storage
COE	US Army Corps of Engineers
CPMM	Cold-Water Pool Management Model
CRR	Cohort Replacement Rate
CV	Central Valley
CVI	Central Valley Index of salmon abundance
CVP	Central Valley Project (Reclamation's Water Project)
CVPIA	Central Valley Project Improvement Act
CWT	Coded Wire Tag
D-1641	SWRCB 1999 Water Right Decision for the Delta
DAT	Data Assessment Team
DBEEP	Delta-Bay Enhanced Enforcement Program
DCC	Delta Cross Channel
Delta Action 8	Salmon survival studies funded under CVPIA
Delta	San Francisco Bay/Sacramento-San Joaquin Delta Estuary
DFG	California Department of Fish and Game
DOI Final Decision	Implementation of CVPIA Section 3406 (b)(2)
DWR	California Department of Water Resources
E/I	Export-to-Inflow Ratio
EFH	Essential Fish Habitat
EID	El Dorado Irrigation District
ESA	Endangered Species Act (U.S.)
ESU	Evolutionary Significant Unit
EWA	Environmental Water Account (CALFED)

FEIS/EIR	Final Environmental Impact Statement/Report
FMP	Fishery Management Plan
Four-Pumps Agreement	Fish Protection Agreement 1986 between DWR and DFG
FRH	Feather River Hatchery
FWS	U.S. Fish and Wildlife Service
GCID	Glen-Colusa Irrigation District
IEP	Interagency Ecological Program for the San Francisco Estuary
IFIM	Instream Flow Incremental Methodology studies
Interior	U.S. Department of the Interior
K	fish condition factor
LAR	Lower American River
LMMWC	Los Malawians Mutual Water Company
M&I	Municipal and Industrial water supplies
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MSA	Magnuson-Stevens Fisheries Conservation and Management Act
NMFS	National Marine Fisheries Service (lit. cited) or NOAA Fisheries (text)
NMIPO	New Melones Interim Plan of Operations
OCAP	Operations, Criteria and Plan (CVP)
OCID	Orange Cove Irrigation District
OID	Oakdale Irrigation District
PCWA	Placer County Water Agency
PFMC	Pacific Fisheries Management Council
ppm	parts per million
Project	CVP and SWP interim operations from April 1, 2002 to March 31, 2004
Prop. 13	State of California programs
RBDD	Red Bluff Diversion Dam
Reclamation	U.S. Bureau of Reclamation
RM	River Mile
ROD	Record of Decision
RPA	Reasonable and Prudent Alternative (ESA section 7)
RST	Rotary Screw Trap
RWQCB	Regional Water Quality Control Board (California)
SAFCA	Sacramento Area Flood Control Agency
SCE	Southern California Edison Company
SFPF	Skinner Fish Protection Facility
SJRA	San Joaquin River Agreement
SLR	San Luis Reservoir
SMSCG	Suisun Marsh Salinity Control Gates
SMUD	Sacramento Municipal Utilities District
SPCA	S.P. Cramer and Associates
SRBS	Stanislaus River Basin Stakeholders
SSJID	South San Joaquin Irrigation District
State	State of California
SWP	State Water Project

SWRCB	State Water Resources Control Board
TAF	thousand acre feet
TCD	Temperature Control Device
TDS	Total Dissolved Solids
TPP	Tracy Pumping Plant
TFCF	Tracy Fish Collection Facility
VAMP	Vernalis Adaptive Management Plan
VSP	Viable Salmonid Population guidelines (NMFS)
WAPA	Western Area Power Administration
WOMT	Water Operations Management Team
WQCP	Water Quality Control Plan
WRO	Winter-run Chinook salmon biological opinion (NMFS, 1993 as amended)
WY	Water Year
YOY	Young-Of-the-Year

National Marine Fisheries Service, PRD Sacramento

Appendix 1

8/14/02

Central Valley Steelhead Counts: Sacramento-San Joaquin River Basins

Year	Juv. Pump Salvage	Coleman FH	Feather FH	Nimbus FH	Mokel. FH	Sac R at RBDD	Sac R	Sac R Sport Harv	Sac R Creel C/R	Battle Creek	Clear Creek	Beegum Creek	Cotton-wood Cr	Antelope Creek	Mill Creek	Deer Creek	Big Chico Creek	Butte Creek	Feather R Creel C/R	Yuba River	Yuba C&R	American Redd Sur.	American Creel C/R	Calav. River	Stan. River	Tuol. River	Merced River	Moke. River	Auburn Ravine	Total Hatchery	Total Wild	All combined
1953															715																715	715
1954															1492																1492	1492
1955															1213																1213	1213
1956				110											1443															110	1443	1553
1957				115											1301															115	1301	1416
1958				51											790															51	790	841
1959				102											417															102	417	519
1960				778											742															778	742	1520
1961				316											1222															316	1222	1538
1962				137											2269															137	2269	2406
1963				2141											1158															2141	1158	3299
1964				1216												1006														1216	1006	2222
1965				778	45																									823	0	823
1966				874	30																									904	0	904
1967		1532		642	17	15312	11330	2450																						2191	13780	15971
1968		3229	563	1183	103	19615	13248	3138																						5078	16386	21464
1969		4939	1005	2449	24	15222	7847	2436																						8417	10283	18700
1970		4046	361	1733	134	13240	7706	2118																						6274	9824	16098
1971		3742		3033	215	11887	6543	1902																						6990	8445	15435
1972		1486	78	2256	14	6041	3588	967																						3834	4555	8389
1973		2645	288	2506	11	8921	4849	1427																						5450	6276	11726
1974		1834	1000	3157	18	7150	4172	1144																						6009	5316	11325
1975		1099	715	2295	2	5579	3587	893																						4111	4480	8591
1976		2162	758	2262		8902	5316	1424																						5182	6740	11922
1977		2069	573	1307		6099	3054	976																						3949	4030	7979
1978		697	163	619		2527	1426	404																						1479	1830	3309
1979		865	153	680		3499	2074	560							280															1698	2914	4612
1980		4264	189	1310		11887	5721	1902																						5763	7623	13386
1981		1118	238	836		3363	1707	538																						2192	2245	4437
1982		1250	141	3190		2757	1041	441																						4581	1482	6063
1983		870	537	1003		3486	1990	558																						2410	2548	4958
1984		521	1238	5155		2036	1181	326												2000										6914	3507	10421
1985		2020	783	910		4489	1687	718																						3713	2405	6118
1986		2042	1721	1193		3769	867	603																						4956	1470	6426
1987		1194	1553	1431	48	2963	1313	474																						4226	1787	6013
1988		890	1018	705		1872	657	300						22																2613	979	3592
1989		467	2587	289	7	470		75						2	28															3350	105	3455
1990		4172	1106	594	11	2272	589	364																						5883	953	6836
1991		1143	1193	223	20	991		159	1083/605																					2579	159	2738
1992	18,729	4429	1,025	1359	29	4032	2517	645	81/651																					6842	3162	10004
1993	18,583	2862	1028	241	108	1511	464	242	419/1045																					4239	706	4945
1994	1594	3387	297	504	83										67	0							537							4271	604	4875
1995	2605	2185	1594	3803	25																									7607	0	7607
1996	5376	3106	877	2257	39					276																				6279	276	6555
1997	1057	2529	1058	1309	46					295																				4942	295	5237
1998	926	1409	2113	509	5					418									94/960		0/760		116/883		0				2	4036	420	4456
1999	2544	1755	1023	1056					0/32	1163																			3	3834	1166	5000
2000	9463	1976	633	1506					165/877	1416									350/4643	11	0/1408		499/4162	20						4115	1447	5562
2001	4525		1742	2877	29					1483		11		165	42	88								20						4648	1809	6457
2002	1879	3388	1429	1253	41					1866	50	20	20	300	300	100	10			100		400		20						6111	3186	9297
average	6,116	2209	905	1601	46	6292	3779	1007		1482		16		63	879	365				1006										3691	2939	6408

1983-1986, Coleman counts include returns at Keswick Dam

RBDD = Sac.River + Sport Harvest + Coleman

DFG Angler Surveys
total CV harvested and released in 2000 = 1014 & 11,090
total CV harvested and released in 1999 = 886 & 10,567
Sac. R. harvested and released in 1991 = 1083 & 6,053
note:equal effort in 1999 and 2000, annual harvest rate = 38% based on RBDD counts

2000 population =(R - H)(2.63) = 26,500
1999 population =(R - H)(2.63) = 25,461
1991 population =(R - H)(2.63) = 13,071

Magnuson-Stevens Fishery Conservation and Management Act Consultation

ESSENTIAL FISH HABITAT CONSERVATION RECOMMENDATIONS
Central Valley Project and State Water Project Operations, April 1, 2002 through March 31, 2004

I. IDENTIFICATION OF ESSENTIAL FISH HABITAT

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended (U.S.C. 180 et seq.), requires that Essential Fish Habitat (EFH) be identified and described in federal fishery management plans (FMPs). Federal action agencies must consult with the National Marine Fisheries Service (NOAA Fisheries) on any activities which they fund, permit, or carry out that may adversely affect EFH. NOAA Fisheries is required to provide EFH conservation and enhancement recommendations to the federal action agencies.

EFH is defined as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. For the purposes of interpreting the definition of EFH, "waters" includes aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include areas historically used by fish where appropriate; "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities; "necessary" means habitat required to support a sustainable fishery and a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers all habitat types used by a species throughout its life cycle.

Sacramento River winter-run Chinook salmon (*Oncorhynchus tshawytscha*) and Central Valley spring-run Chinook salmon (*O. tshawytscha*) will potentially be affected by the proposed action, but are listed under the Endangered Species Act (ESA) as well as covered by the MSA. Measures to avoid and minimize project impacts to these species and their habitat are thoroughly addressed under the biological opinions (i.e., NOAA Fisheries 1992 and amendments, and the preceding interim biological opinion, respectively) required as part of the ESA consultation process. Therefore, this EFH consultation will concentrate primarily on Central Valley fall/late fall-run Chinook salmon (*O. tshawytscha*) which also is covered under the MSA, but not listed under the ESA.

The Pacific Fishery Management Council (PFMC) has identified and described EFH, Adverse Impacts and Recommended Conservation Measures for salmon in Amendment 14 to the Pacific Coast Salmon Plan (Salmon Plan) (PFMC 1999). Freshwater EFH for Pacific salmon in the Central Valley includes the waters currently or historically accessible to salmon within the Central Valley ecosystem as described in Myers et al. (1998). Historically, fall-/late fall-run Chinook salmon spawned in the Central Valley and lower-foothill reaches up to an elevation of approximately 1,000 feet. This spawning habitat is generally downstream from existing dams, which has precluded some of the direct habitat loss that has impacted other Central Valley Chinook salmon species.

II. PROPOSED ACTION

This EFH consultation addresses the proposed operations of the Central Valley Project (CVP)/State Water Project (SWP) facilities from April 1, 2002 through March 31, 2004, as described in Section II, (*Description of Proposed Action*) of the preceding interim biological opinion. The project description in that document is incorporated here by reference.

III. EFFECTS OF THE PROJECT ACTION

The effects of the proposed action on salmon habitat are described at length in Section V *(Effects of the Action*) of the preceding interim biological opinion, and also are incorporated by reference. CVP/SWP operations will adversely affect the freshwater EFH of Central Valley fall-/late fall-run Chinook salmon by continuing to modify the pre-CVP/SWP or natural conditions of the Sacramento-San Joaquin River systems. The operations will affect EFH through regulated flows that dampen historic spring freshets and increase the flows later in the hydrologic cycle. Manipulation of the aquatic environment for irrigation and municipal/industrial uses also will result in higher temperatures in-stream due to water extractions that lead to low instream flows, warm agricultural return flows, warm surface water releases from storage reservoirs, and shifts in flow patterns. Adult fall-/late fall-run Chinook salmon returning to spawn may be adversely impacted by high water temperatures in the fall if seasonal rains and runoff are late and if flows are captured by CVP/SWP operations to enhance refill of reservoirs before the onset of the fall/winter rainy season. Under these circumstances, water temperatures may exceed lethal levels for adults waiting in-river for water temperatures to drop below 60 °F for successful spawning. Residing in temperatures above 60 °F may also adversely affect the viability of eggs that are spawned later. However, as "ocean-type" stocks, fry and juvenile fall-/late fall-run Chinook salmon will usually migrate from the Central Valley during their first year of life and generally before six months of age. This life history characteristic generally avoids the more severe impacts of temperature and flow regime changes that may affect fry and juvenile spring-run Chinook salmon and steelhead.

Pumping facilities and diversion points, including the CVP and SWP Delta pumps, that were not part of the pre-development environment will continue to entrain fall-/late-fall Chinook in the Sacramento-San Joaquin Delta or delay them as they emigrate to the ocean. Pumping rates in the Delta affect the direction, volume and net flow of water through the Delta. Emigrating salmonids, including fall-/late-fall Chinook salmon, may be delayed by these changes and the delay may result in increased mortality due to entrainment and predation.

Development of the Sacramento-San Joaquin River systems for human water use has resulted in the displacement of other anadromous salmonids from cool headwater environments to the tail-waters below the major dams in the Central Valley. Therefore, project operation is likely to result in increased spawning and rearing habitat overlap between fall-/late fall-run chinook salmon and other salmonids, which may lead to increased competition for food and space, and genetic introgression.

IV. CONCLUSION

Based on the best available information, NOAA Fisheries believes that the proposed action is likely to adversely affect EFH for fall-/late-fall Chinook salmon managed under the Salmon Plan.

V. EFH CONSERVATION RECOMMENDATIONS

The habitat requirements of Central Valley fall-/late fall-run Chinook salmon within the action area are similar to those of the federally listed species addressed in the preceding interim biological opinion. Therefore, NOAA Fisheries recommends that Reasonable and Prudent Measures numbers 1 through 7 and their respective Terms and Conditions listed in the Incidental Take Statement of the preceding interim biological opinion prepared for Central Valley spring-run chinook salmon and Central Valley steelhead be adopted as EFH conservation recommendations. Likewise, NOAA Fisheries recommends that ESA Conservation Recommendations numbers 1 through 8 be adopted as EFH conservation recommendations. Finally, NOAA Fisheries recommends the following two EFH conservation recommendations specifically targeting Central Valley fall-/late fall-run Chinook salmon:

1. Reclamation and DWR shall to the extent possible use flow releases below Nimbus Dam and Oroville Dam to control the daily average water temperature in the American River and Feather River, respectively, to less than or equal to 60°F from November 15 to December 30. This will protect spawning fall-run Chinook salmon and incubating eggs from thermal stress.

2. Reclamation should expedite construction of temperature control devices on Folsom Dam for the Eldorado Irrigation District and City of Folsom water supply intakes. Use of these devices would substantially improve the cold water pool available in Folsom Reservoir for fall releases until fully automated shutters can be installed.

Section 305(b)4(B) of the MSA requires Reclamation to provide NOAA Fisheries with a detailed written response within 30 days, and 10 days in advance of any action, to the EFH conservation recommendations, including a description of measures adopted by Reclamation for avoiding, minimizing, or mitigating the impact of the project on EFH (50 CFR § 600.920[j]). In the case of a response that is inconsistent with our recommendations, Reclamation must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NOAA Fisheries over the anticipated effects of the proposed action and the measures needed to avoid, minimize, or mitigate such effects.

LITERATURE CITED

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